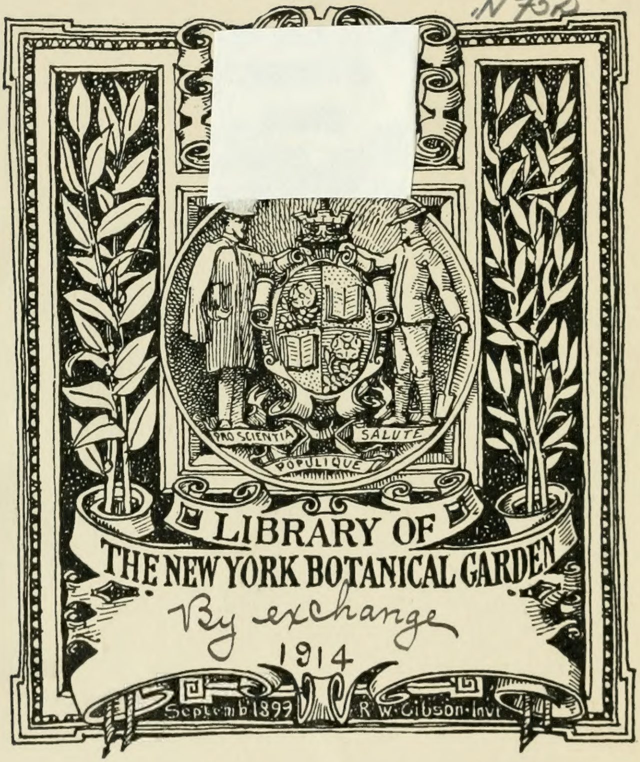
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TWENTY-SIXTH ANNUAL REPORT

OF THE

New York State College of Agriculture

AT

CORNELL UNIVERSITY

AND THE

Agricultural Experiment Station

Established under the Direction of Cornell University

ITHACA, N. Y.

1913

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CORNELL
Rural School Leaflet

[FOR BOYS AND GIRLS]

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ALICE G. McCLOSKEY and EDWARD M. TUTTLE, Editors

ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

Vol. 6 ITHACA, N. Y., NOVEMBER, 1912 No. 2

BIRDS

ALICE G. McCLOSKEY

It does not seem very long since we were all watching the return of the birds as they came north in the springtime. We shared their songs; we shared their happy hours in nest building; we shared the larger life that the presence of birds always gives. During the summer days we listened to the merry notes of the bobolink; the blue bird called in his wonder way; day after day the song sparrow cheered us; the pewee's plaintive note came to us from the tree tops; and the phœbe's shy call lured us to the places that he found most lovesome. Since then we have seen flocks gather and take their flight to sunnier lands. We rejoiced in the fact that all did not go; that here and there in garden and orchard and woodland, however snow-choked, some bird comrades stay, as we do, to take part in the magic of winter.

Why do birds go south? Almost every boy and girl will answer, "Because it is cold in the north." But that is not the reason. The birds go south because where the sun is warm they will find the food that they need. The birds that remain with us over winter are those that can thrive on the insect life and the seeds found in the winter wood and field.

I suppose you all know that throughout New York State boys and girls in the public schools will study certain birds this year. What an interesting list we have for the coming months: the oriole, peacock, black-and-white warbler, goldfinch, phœbe, cliff swallow, brown thrasher, grackle, meadow lark, and bald eagle! Added to these, two winter birds will be studied. You may choose any of the winter birds that you enjoy most, but we are going to suggest that you look for the *red-headed woodpecker*,

which is a winter bird in some parts of the State, and for the *tree sparrow*. They are both interesting and perhaps you may have an opportunity to see them. The following will aid in the search:

The red-headed woodpecker

The red-headed woodpecker.—How shall you know a red-headed woodpecker? It is one of the very handsomest of our birds. It has, of course, the woodpecker bill and is readily known by its handsome blue-black

and white coat and brilliant red head. The neck and the forebreast are also red.

Food must be plentiful to enable the red-headed woodpecker to remain all winter. It is said that this bird stores up food for a "rainy day." The story is told that a naturalist once found many grasshoppers wedged into an old fence post. They were alive but could not get away. By and by their jailor appeared. He was neither somber nor ugly, as you

The tree sparrow

might suppose, but a merry red-headed woodpecker. He had no thought of cruelty in his little red head. He had used the fence post as a cold storage place and had filled it with a good supply of food. The writer did not see the grasshoppers wedged into the fence post and so cannot say that the story is true. Boys and girls should keep a lookout and find out whether a red-headed woodpecker has habits of storing supplies in some such way as this.

The tree sparrow.—This is a winter bird that some of us may see. It is brownish, with gray, unstreaked underparts, reddish brown cap, and

A Christmas tree for the birds

two white wing-bars. There is a single dark spot in the middle of the breast. The tree sparrow looks somewhat like the chipping sparrow, but the dark spot on the breast will identify it. Then, too, we know that the chipping sparrow is not one of our winter birds. Try to see a tree sparrow this year and try to hear the tender little song that it sings in April before it goes to its nesting place in the Far North.

The nuthatch.— In looking for winter birds remember that the bird for special study this year is the nuthatch, which is one of our common winter birds. It is bluish gray in color, and in size is a little smaller than the English sparrow; the top of its head is black but it differs from the chickadee, its throat and entire underparts being white. It is generally seen on the trunks or the larger branches of trees, where it climbs about very differently from the woodpeckers for it is frequently upside down and it never uses its tail as a support.

You must remember that the nuthatch is one of the birds that eat insects and therefore it is most important to the farmer. Men who have studied the subject report that millions of injurious insects are eaten by a single nuthatch in a year. Its bill is adapted to slip under rough

bark where the eggs or the young of insects are hidden. In this way many insects that might become great pests are held in check by the industry of the nuthatch. It eats weed seeds also. We should feel much appreciation for a farm helper that will prevent a greater spread of injurious forms of life.

I am sure that sometimes in midwinter it must be very hard for nuthatches and other birds to get all the food which they should have. It would be well, therefore, to leave some suet or beef fat fastened to a tree in the school yard or in your own home garden, so that the little farm workers may be helped over hard times. Why not have a Christmas tree for the birds? Choose any evergreen near your home or school. Fasten to the branches some suet or beef fat. Perhaps seeds might be left in a basket if tied firmly to a strong branch. It is said that some birds will eat peanuts. String the nuts as you would pop corn and watch the results. Woodpeckers, nuthatches, chickadees, blue jays, crows, and other birds may visit the Christmas tree. This will give a good opportunity to study them.

THE POTATO

ALICE G. McCLOSKEY

Many boys and girls are not interested in plant life unless it is attractive. Some enjoy the wild flowers of the springtime, the brilliant wayside blossoms of the autumn, or the cultivated garden plants that have been grown to make a bit of color round about the home. In fact, almost all boys and girls are interested in such forms of plant life.

There are other forms of growing things, however, that are very interesting to persons who are willing to spend time in the study of them. These are the useful plants that are grown throughout the country. If one were to know the history of all the farm crops, he would find many wonderful stories connected with them. Some were brought to New York State from other lands. Some that in their native lands were not very valuable have become most valuable in a different place. It would be interesting to trace the history of some of the plant life that we find in orchards and fields at the present day.

Among the most valuable farm crops in New York State we find the potato. It has an interesting story connected with its introduction into this country, and an interesting life history as we now find it. Ask your teacher to tell you something about the way in which the potato was introduced into the United States. It belongs to the same family as does the tomato and as does the bittersweet that you see climbing along fences and stone walls by the roadsides. If you notice the blos-

soms of the tomato vine, the blossoms of the bittersweet, and the blossoms of the potato, you will see one way in which these plants resemble one another.

We want the boys and girls in New York State this year to know something about a potato crop. Why should you not, even if you should never grow potatoes on a farm of your own? Almost every day you have potatoes for food; you see them in the markets; perhaps you wonder about them when you stand in the cellar and see them sprouting and making an effort to reach up to the light.

Let us have in the rural schoolhouse a special lesson on the potato. We might try it in this way: Are there ten boys and girls in your school who can read? If so, let each copy one of the questions given below. Put all the questions into a box and have each of the ten children draw one. Let us say John Mason drew No. 1. He should read over his question carefully and get all the information connected with it that he can during the following week, from his father and from any farmer in the neighborhood. He should also ask the teacher to let him read the article beginning on page 117 in the teachers' leaflet, in order to see whether he can find an answer to his question. Let each of the other boys and girls do the same with the questions that they have drawn. Then some Friday afternoon have a report to find out which boy or girl has been most successful in his quest. This will be good preparation for the study of the potato to be given in the next leaflet. The questions are as follows:

1. What kind of soil is best for potatoes? What must the potato grower do if his soil is not in good condition for a potato crop?

2. What is the best crop to immediately precede the potato crop? Why?

3. When and how should the potato field be plowed?

4. How should the potato field be marked?

5. How is the best seed secured? Which is the better practice, to plant medium or small potatoes from high-yielding hills or to plant a large tuber from a low-yielding hill? Is it a good thing to use seed that has sprouted? How should the potato be cut for planting? Why should potatoes be planted immediately after cutting?

6. How should potatoes be planted? State depth of soil; number of pieces in a hill; and the like.

7. Can you show the class ten potatoes that differ very much in size and shape? Can you show the other boys and girls how you know that the potato is an underground stem and not a root?

8. What is the best way to dig potatoes?

9. What is the best way to store potatoes?

10. Who had the largest potato crop in your community last year? When, where, and how were the potatoes marketed?

POETRY AND THE OUT-OF-DOORS

ALICE G. McCLOSKEY

A BOY or girl on a quest for something to read, very rarely looks for poetry. Young persons nearly always want something that has conversation in it. Isn't this true? There have been boys and girls, however, in the past, and there are many in the present, who really like to read poetry and sometimes to memorize it. It is so worth the while to do this that we wish you would all try to like something written in verse and be willing to commit it to memory. When you write your letters to Mr. Tuttle this month we shall be very glad to know that you have studied potatoes, the locust tree, your garden crops, poultry, and the other practical farm lessons. We shall also be glad to know that you have been watching the winter birds, that you have been trying to find out which of the wayside flowers remain the longest, that you have been thinking much about the stars and the moon and the other outdoor wonders, and we shall be equally glad to know that you have learned the poems in this leaflet. Here are two good stanzas to begin with, written by Robert Louis Stevenson:

"*Great is the sun, and wide he goes*
Through empty heaven without repose;
And in the blue and glowing days
More thick than rain he showers his rays.

* * * * * *

"*Above the hills, along the blue,*
Round the bright air, with footing true,
To please the child, to paint the rose,
The gardener of the world, he goes."

When you read the foregoing lines we hope you will think about the summer sun. We are so accustomed to having this wonder in nature that many of us have ceased to think about it. To become familiar with each sunrise, with each noonday light, with each sunset, should give much joy and new joy continually. We watch the sun as it rises over the hills or sets behind the hills; we respond to the brightness; we respond to the warmth; we respond to the many out-of-door things that sunlight reveals.

And have you ever watched the way in which the plants reach out for light? Note every goldenrod stem, all the leaves of the trees, all the little plants close to the ground — the way in which each leaf tries to find the place that will give it the most sunlight. We do not find the leaves of the common plants hiding one another from the light, but instead each leaf finds the place that will give it the benefit of the greatest number of sunbeams. Take to school four or five wayside plants some day this fall and show the teacher how the leaves are arranged so as to get the light.

But we do not always have sunshine. Many times clouds cover the sky and we have our wonderful gray days. Then the trees look different and the fields look different and stillness is in the air. I am wondering what kind of clouds you all like to watch best. Sometimes I think I like the great dark clouds of late autumn, filled with the promise of winter. How low they seem to lie over the hills! But when I think of all the other clouds I am not sure. For are not the heavy white clouds that we see in spring and summer most wonderful of all? And can one ever forget the clouds at sunset that have helped the young May moon to play hide-and-seek with us?

I hope you will care to learn the poem called "The Cloud," written by Shelley. At least learn this stanza:

"I bring fresh showers for the thirsting flowers
From the seas and the streams;
I bear light shade for the leaves when laid
In their noonday dreams.
From my wings are shaken the dews that waken
The sweet buds every one,
When rocked to rest on their mother's breast
As she dances about the sun.
I wield the flail of the lashing hail,
And whiten the green plains under;
And then again I dissolve in rain,
And laugh as I pass in thunder."

And one thing more. Besides enjoying the sunlight and the clouds, we must learn to love the rain. Boys and girls do love the rain, I think, and often want to be out in it. One difficulty is that they are not always comfortably dressed for rainy days. What joy it is when we have rubber boots and rubber coats and a good old sou'wester hat and can go forth in teeming rain and care not how hard it comes down nor how wet are the fields or the woods! We love to trudge along the great highways and let our well-clad feet sink into the deep, soft mud. How fresh one feels out in the storm of the wind and the rain! Following is a poem that we should like to have you learn during the month. Through this you will find new joys in rainy days.

A RAINY DAY*

L. H. Bailey

THE soft, gray rain comes slowly down,
Settling the mists on marshes brown,
Narrowing the world on wood and hill,
Drifting the fog down vale and rill.
The weed-stalks bend with pearly drops,
The grasses hang their misty tops,
The clean leaves drip with tiny spheres,
The fence rails run with pleasant tears.

Away with care! I walk to-day
In meadows wet and forests gray; —
'Neath heavy trees with branches low,
'Cross splashy fields where wild things grow.
Past shining reeds in knee-deep tarns,
By soaking crops and black-wet barns,
On mossy stones in dripping nooks,
Up rainy pools and brimming brooks
With waterfalls and cascadills
Fed by the new-born grassy rills; —
And then return across the lots
Through all the soft and watery spots.

Away with care! I walk to-day
In meadows wet and forests gray.

* Courtesy of The Century Company.

TREES

ALICE G. McCLOSKEY

IT is surprising how many persons in the world have lived among a number of different kinds of trees all their lives and yet scarcely know one from another. There is no better way to train the mind than to become a good observer. To study the trees in your neighborhood will help to train your mind for many other lines of work. We are hoping that every boy and girl in rural districts this year will be able to give the names of at least twenty-five trees in the vicinity of the school. If you come across a tree that no one can name for you, let us have a small piece of one of the branches, if possible with a leaf or two. If you want to know the name before the leaves come out, we shall probably be able to identify it from a twig. With the specimen that you send, be sure to give a description of the shape and size of the tree and tell us where it grows — in wood, orchard, or along the wayside.

Some people become familiar with trees without observing closely all the parts. The writer knows an old woodman who in one day named more than fifty trees by merely looking at the bark; he did not seem to notice the leaves at all. Years ago this man had been sent to cut lumber in the forest and had become familiar with the different trees that were needed. It is a good thing, however, to know the trees by the leaves, by the blossoms, and by the habit of growth, as well as by the kind of bark.

The special tree for study in New York State this year is the *locust*. This is a valuable tree because the wood is tough and strong and does not decay easily. From the locust tree railroad ties and posts are made, and it is used for other purposes for which a strong, tough, durable wood is needed.

Leaf and fruit of common locust

The locust tree belongs to the same family as do peas and beans. This will seem strange to you until you think of the pods that you find on the locust tree. You will remember then that peas and beans also have pods, and you can see at least this one reason why peas, beans, and locust trees are classed in the same family.

Are you sure there is a locust tree in your neighborhood? If you have never seen one and have never heard of one, ask some farmer whether he has ever seen one. If you find that you have locust trees for study note the following:

What is the shape of the tree?

Where does it grow — along the roadside, in the garden, or in the wood?

How long do the pods stay on the tree?

How many seeds do you find in a pod?

Watch for the leaves in spring.

Watch for the blossoms.

Have you ever known a locust tree in your neighborhood to become diseased and die? This tree was doubtless attacked by an enemy, the locust borer, which is very difficult to destroy. The forester tells us that the only thing to do when locust borers get into the trees is to cut the trees down and burn them.

LETTER TO BOYS AND GIRLS

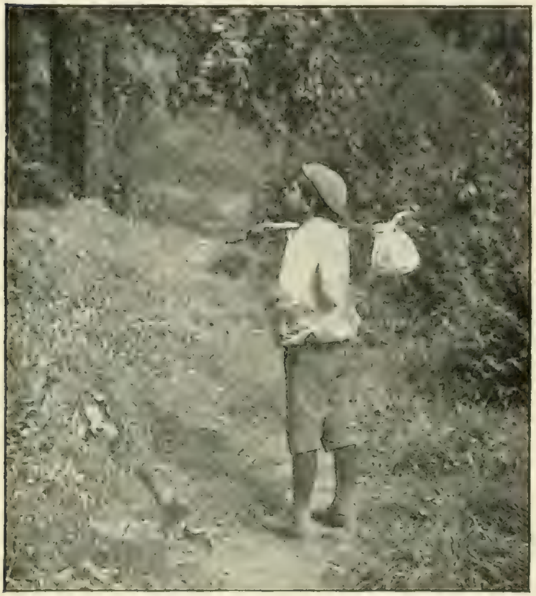
DEAR Boys and Girls:

It is good to be writing to you all again after so long a time. Some of us are old friends for we wrote to each other last year. But one and all, old friends and new, we are going to take hold this year and come to know each other better. We shall do this by finding something in which we are interested.

The long summer holidays are over and you have been back in school for a number of weeks. Did you like to go back? I know of some that did, for they have already written and told me so. I am not so sure of others. I wonder whether, when a boy or girl doesn't like to go to school, the trouble is with the school or with the boy or girl. I wonder whether, if we took some spirit and interest to school with us, we should find that we liked school better. Have you proved this in your own experience?

I have been thinking a good deal lately about my young friends living in every part of this great State. I am glad that your homes are in the country for that is the finest place for boys and girls. Perhaps not all of you expect to stay there always but many of you do, and I hope that you will think twice before you leave it. At the present time farming offers as great an opportunity as does any line of work. It takes as much ability and education to be a successful farmer as it does to be a successful lawyer or engineer. The farmer must have knowledge of the out-of-doors and

knowledge of men: the first, in order that he may produce goods of high quality at low cost; and the second, in order that he may dispose of them to advantage and be a good citizen in his community. To truly succeed in any work is no easy task; if it were easy there would be nothing to strive for.



In the woods

I hope you will read this leaflet carefully. In it there are a number of lessons, each of which deals with out-of-door life that is related directly or indirectly to good farm practice. None of the lessons are useless; they have some value or we should not send them to you. I know you will get all that you can out of the lessons and the letters.

One piece of work that I should like to suggest for these fall days is that we all get ready for winter. Harvest time is over now and the days of Thanksgiving are here. Let us pick up, clean up, and put in order the school and the home, the school yard and the home grounds. Perhaps there is some old lumber that we can pile up neatly or a piece of machinery that we can place under cover out of sight or some leaves that we can rake up or weeds that we can cut. Perhaps inside the house the girls can help mother in making things more homelike and attractive: clean curtains at the windows, a new cover for the couch, a picture neatly framed and hung, a red geranium on the window sill to brighten the room. Then when winter comes everything will be snug and trim, and springtime will find us with orderly surroundings at the start.

Do not forget Corn Day, which comes this year on Friday, December 6. You will find something about it on page 946

The letter from Edward Haag published in this leaflet is one that I received last spring. You will be interested in it.

Often letters come to me containing descriptions of birds or plants or some other object which I am asked to have identified. Sometimes the

description is not complete enough and it is impossible for us to be sure what it represents. Will you try to tell me all that you can find out about the object, because by doing so you will not only help us to help you, but you will be learning to look more closely at things yourself.

Whenever you write to me, either in school or at home, I wish you would be very sure to put the number of your school district, the name of the township, and the name of the county at the top of the letter. Form the habit of doing this because it helps me a great deal in keeping an accurate record of your letters. Often I have great trouble to locate a letter, and I want to be certain that all who deserve the picture which is given for letters from boys and girls shall receive one; so if you will do your part by giving me the full address on every letter, I shall be able to do my part much more quickly. I hope that all of you will write the three letters this year and get the picture, but do not feel that you must stop at three. Write to me as often as you like, for I am always glad to hear from you and I promise to read every letter even though I cannot answer many. I am afraid some of you were disappointed that I did not write to you personally last year. You will believe that I wanted to, and that I am doing all that I can every minute. Have faith in me and hold to our friendship. Some day we may both be glad of it.

There is one thing I want to ask of you boys and girls. Try to be very gentle and considerate toward others. It costs nothing; and how great is the satisfaction when one has done a kind thing, or has been strong enough to refrain from doing anything unkind! I do not mean that you should be "goody-goody" in your attitude. Always remember that the strongest people are the most gentle and tender. Watch and see whether this is not so. To be loved by our fellows is the greatest of all joys, but to win that love we have to be worthy of it. Do not needlessly hurt any one's feelings; do not make fun of your playmates; do not lose your temper. If you are not able honestly to speak well of a person, say nothing. Better silence than unkind speech. Think about this, for even the oldest of us can find room for improvement.

This is a long letter, but you will have plenty of time to read it before the next one in January. *The things to remember are to read the leaflet thoroughly, to do some fall cleaning up, to celebrate Corn Day, to send in full and accurate descriptions, to put on the top of each letter where your school is located, and to be respectful and considerate of others.* Write often and tell me all that you are doing and planning. Remember that at the College of Agriculture at Ithaca you have

A true friend,

Edward M. Tuttle

A BOY'S LETTER

Geneva, N. Y.

Dear Mister Tuttle:

I am a little boy eight years old. I go to the district school No. 7 in the town of Geneva. My teacher's name is Miss Mary E. Dowd.

I live on a farm with my parents and my brother. My brother is ten years old. Our farm is a fruit farm. We have apples, pears, plums, peaches, cherries, and several kinds of berries. I have planted some trees for myself. I have one apple tree and three peach trees. I planted two peach trees last year. One died, the other one is growing fine. When picking time comes, we have to go every morning to Geneva to get some boys and girls and women to help pick the fruit. Then we have a good time and make a little money besides. Last year I made over ten dollars picking fruit. I will try to do better this year.

And we had our pictures taken last year. My father tells me that when I am old enough I will have to go to Cornell to study fruit-growing. I have been to Ithaca and seen all the college buildings. They are very fine. I like them.

Yours truly,
Edward Haag

CORN DAY

(friday, december 6, 1912)

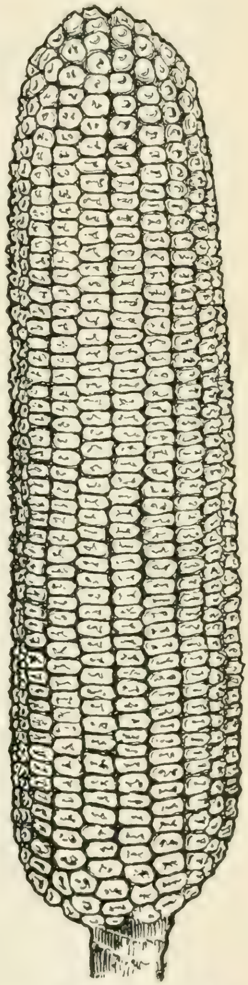
Edward M. Tuttle

We have decided this year to change the date of Corn Day from late January to early December, because that will bring it closer to the harvest time and thus do away with the necessity of storing the corn so long. All the letters that we have received in answer to our question regarding this change have been in favor of it.

Corn is one of our most important cereal crops and is grown extensively in New York State. It is well, therefore, that we should know as much about corn as we can. The plan of having one day in the year in which all rural schools shall have a corn celebration is several years old now. Each year a larger number of schools are holding Corn Day exercises.

We want every rural school to have a special interest in corn on December 6 this year. If nothing more is done than to study a single ear, a start will have been made. Many schools have quite extensive programs on Corn Day. Selections on corn are committed to memory and recited, an exhibit of the various kinds of corn grown in the neighborhood is brought in and arranged by the boys and girls, and often the girls prepare articles of food from corn, such as corn bread, corn meal mush, and the like.

But above all, Corn Day should be a time when fathers and mothers and friends shall come to the school and strengthen their friendship with the teacher and learn what the young persons are doing. Often a school will send out to the grown folk attractive invitations on which there is a drawing or picture of corn. Indeed, there are any number of things that come out spontaneously in each school in which plans are made for a good Corn Day.


A good ear of corn

In selecting the samples of corn for the exhibit, ten ears are usually considered a unit sample. These ten ears should be all of the same kind of corn, and they should be as nearly alike as to size, shape, and color as it is possible to get them. Arrange each set of ten ears by itself and label it carefully. A very good plan is to ask a farmer in the neighborhood to judge the corn brought into the school on Corn Day. This will give an opportunity to study the differences between good corn and poor corn.

Although we have printed many times before the following description of a good ear of corn, written by Professor Gilbert, we feel that it cannot be read too often and that if kept constantly in mind it will serve as an ideal to strive for. While the description applies primarily to dent corn, it may be made to apply to flint corn as well.

1. *Shape of ears.*—A perfect ear of corn should be full and strong in the middle part, indicating a strong constitution. It should retain this size to near the tip and butt, thus forming as nearly as possible a cylindrical ear.

2. *Butts of ears.*— The rows of kernels should extend well down over the butts of the ears, thus giving an ear of better appearance and containing a higher yield of grain. The shank, or the part of the stalk that is attached to the ear, should not be too large and coarse. Swelled, open, or badly compressed butts, as well as those having kernels of irregular size, are objectionable.

3. *Tips of ears.*— The tips of the ears should be well filled out, indicating a type of corn that will mature easily. The rows of kernels should extend in a regular line to the extreme tip of the ear.

4. *Shape of kernels.*— The shape of the kernels is very important. They should broaden gradually from tip to crown, with edges straight so that they will touch the full length, and should be wedge-shaped without coming to a point. Kernels of this shape will fit close together and thus insure the highest possible yield of grain that can grow on the cob. If the kernels have this wedge shape, no wide spaces will be found between the rows. Such spaces are always objectionable.

5. *Proportion between corn and cob.*— There should be a large proportion of grain as compared with the amount of cob. This will be the case with ears having deep kernels. A large ear does not necessarily indicate a heavy yield of grain, and it is objectionable in that the cob, being large, contains a considerable amount of moisture which, drying out slowly, injures the grain for seed purposes.

6. *Color of grain and cob.*— Good corn should be free from admixture. White corn should have white cobs and yellow corn should have red cobs.

7. *Trueness to type or race characteristics.*— The ears selected for an exhibit or for breeding purposes should be uniform in size, shape, color, indentation, and size of kernel. They should also be true to the name of the variety.

From each school in which Corn Day is celebrated this year we should like to receive the very best *single* ear of corn shown in that school at the exhibit. It may be either flint or dent corn and need not necessarily be the largest ear, but it should be the most perfect ear according to the printed ideal above. Label this ear carefully, giving the number of the school district, name of the township, name of the county, and the teacher's name; also the variety of corn if it is known. Wrap carefully the single ear of corn, making a secure package, and send it *by mail* to Edward M. Tuttle, College of Agriculture, Ithaca, New York. If no other writing except the label is put in the package it can be sent at fourth-class rates, one cent for each ounce or fraction of an ounce. We shall make a note that your school has celebrated Corn Day and shall keep the ear of corn for our Farmers' Week exhibit in February, at which time we shall give one prize for the most perfect ear of dent corn and one for the most perfect ear of flint corn that we have received. Then we shall probably have the two most perfect ears of corn in the State.

Bear in mind that we want only one ear, the very best one, from each school. Send it as soon after Corn Day as convenient and we will take care of it. Every school should be represented. In this way our boys and girls will be taking part in Farmers' Week.

CORNELL
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ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

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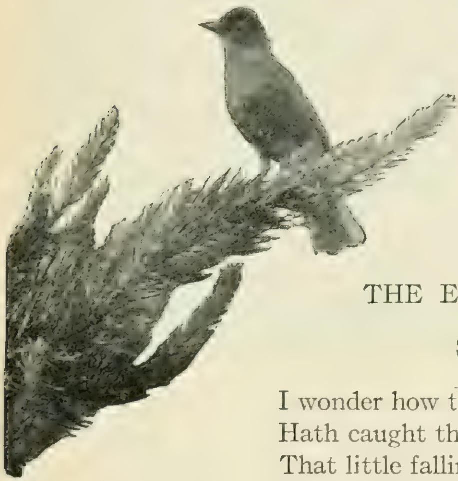


THE ENCHANTMENT*

SARA KING

I wonder how the robin's throat
Hath caught the rain's sweet dripping note,
That little falling, pelting sound,
Liquidly clear and crystal round,
The very heart-rune of the Spring,
Enchanted of the sky and ground,
That conjures life from everything.

No ancient, age-worn witchery,
No incantation, could set free
The fast-bound dead; yet here each day,
Robin and rain in mystic way
Bring life back greenly; ah, and how
One's very heart and pulse obey
That lure of music! Listen now . . .

*From HARPER'S MAGAZINE, Copyright, 1912, by Harper & Brothers.

FIRESIDE TALK

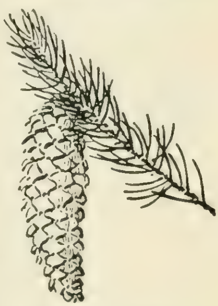
ALICE G. McCLOSKEY

It is a year since we were all together sitting around the roaring wood fire. Do you remember how the wind blew and how we listened to the vines striking against the windows? Do you remember how the branches of the trees creaked? I am sure that you do and that you can still recall the starlit sky of the cold January night. Here we are again, you and I, popping corn as before, occasionally looking at the rosy apples in the basket, and telling each other what we are going to do during the late winter days — the days most interesting of all, when spring draws near.

You are a year older, those of you who last January watched the firelight with me. You have been interested in many outdoor things and have come to know many. You have stopped grumbling about the weather and are now enjoying the splendor of wind-swept highways and icebound dooryards. You coast and skate and skee and in every possible way find the comradeship of winter. You fill the woodbox at night and have learned to wonder about the sticks as you make them ready for the home evening. You wake up in the morning and hurry down to the old kitchen stove to get warm, glancing the while at the frost pictures on the windows, and wondering at the strange early morning light that winter

sunshine makes. Oh, this is a good old time of year and no one who sits about our fireside is going to grumble about it!

There is one thing that I want you all to do this year, that is, all of you who are old enough. Will you read "Snowbound," by the New England poet, John Greenleaf Whittier? You can buy this poem — which will interest every boy and girl over eight years old — for five cents by sending for it to the Owen Publishing Company, Dansville, New York. Perhaps each boy and girl can own a copy. The little book will have a paper cover, but the printing is good and you will like to add it to your own library. I recall a rural school in which, years ago, the boys and girls learned all of "Snowbound," and they liked to recite it better than anything else. Whenever the wind blew cold and rattled the schoolhouse windows, and the snow came down in sheets, covering the neighboring meadows, the boys and girls would ask to be allowed to recite "Snowbound," and they had such a good time doing this!


Norway spruce

There are a number of things that we want you all to do in the coming months, but perhaps the most important of all is to have your teacher or your father send for seed catalogs; because winter is the time to decide what you are going to plant next spring. Almost any good seed house will send a catalog to your teacher or your parents. Merely looking through these catalogs will give you much information about growing things, and this year we want every boy and girl in New York State to grow something: to raise vegetables or flowers or a quarter-acre of corn or a quarter-acre of potatoes, to start a fruit garden with the help of father, or to plant some grape vines. Things that you grow yourselves will give you the greatest pleasure. In our next leaflet we shall send you some directions for planting, but we want you to learn all that you can for yourselves by reading during these winter days. When you write to tell Mr. Tuttle that you have bought a copy of "Snowbound," will you tell him also whether you have looked through a seed catalog, and whether you have made up your mind what you would like to grow next spring?

Then another thing: I am wondering how many of you are familiar with all the evergreens in your neighborhood. This year you are to study the Norway spruce and the balsam fir. While looking for these for a lesson at school, why not bring in small branches of all the evergreens that you find and see whether you can name them? You may find the pitch pine, with three needles in a bundle, which we studied some time ago, and the white pine, with five needles in a bundle, which you studied last year. It is not so easy to tell the difference between the spruce and

the fir, but have in mind the following: Norway spruce: *Bark*, reddish gray; *needles*, four-sided; *cone*, long, light brownish yellow. Balsam fir: *Bark*, light gray and frequently has blisters that contain liquid resin; *needles*, flat, with light gray streak on the underside; *cone*, dark purple when young, dark brown when ripe.

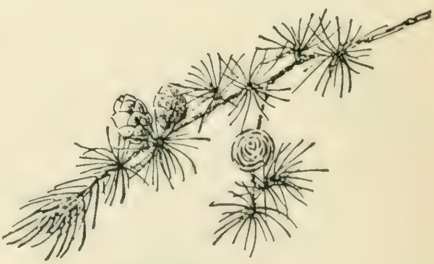
Balsam fir

One of the trees for study this year, often taken for an evergreen, is the tamarack. When you see one in summer you might think it is an evergreen because the leaves are needle-like and the tree bears cones. If you watch one, however, you will find that it sheds its leaves in winter. To me there is no more attractive tree than a little tamarack. Many of you have read "Hiawatha" and will remember what he says when he speaks to this tree:

"Give me of your roots, O Tamarack!
Of your vigorous roots, O Larch-Tree!
My canoe to bind together,
So to bind the ends together
That the water may not enter,
That the river may not wet me!"

Look for a tamarack (called also a larch) in your neighborhood, and, if you find one, watch for the leaves and blossoms in the spring; for a tamarack does have blossoms and you will find them very wonderful in color.

Be sure that you write to Mr. Tuttle this month and tell him whether you have read "Snow-bound," whether you have looked through a seed catalog, and whether you have studied the evergreens in your neighborhood.

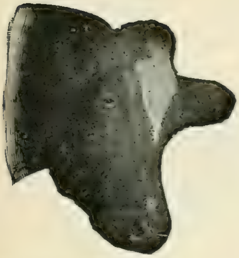


Tamarack, or larch

Now it is growing late and you will all have to run home. I shall watch you from my window. How wonderful the out-of-doors is in the starlit night! The sparkling snow, the rugged, leafless trees, the whistling wind, all in touch with your brave young hearts.

COWS

E. S. SAVAGE



The cattle-bearing sections of the United States.— There are in the United States about fifteen millions of cows, both beef and dairy. The question naturally arises, in what States are they found? There are some cows in every State; but there are six States in the Union which deserve the title "The Six Great Dairy States," and five States which deserve the title "The Five Great Beef States." The great agricultural State of Iowa is found in both these lists, therefore it has the title "The Greatest Stock-Growing State." Texas, also, is found in both lists, but it does not stand so high as Iowa because of the vastness of its area.

Our own State of New York is the greatest dairy State in the Union, with 1,589,594 cows; Wisconsin has 1,437,505; Iowa, 1,406,792; Minnesota, 1,085,388; Illinois, 1,050,223; and Texas, 1,013,867. No other State has more than 1,000,000 dairy cows.

In numbers of beef cattle, Texas outranks the others by far, having 2,469,321 beef cattle. It must be remembered that the area of Texas is vast. Nebraska has 705,191 beef cattle; Iowa, 614,930; Kansas, 558,153; and Montana, 372,798. No other State in the Union has more than 200,000 beef cattle. Thus it is seen that, in this country, cattle are raised in largest numbers in the northern tier of States and in the Mississippi Valley.

Elgin, Illinois, is the greatest butter-market in the United States and the Elgin Board of Trade governs the price of butter in the Middle West. New York City is the greatest milk-consuming city in the United States. Chicago is the greatest market for beef cattle. Other great beef markets are Kansas City, St. Louis, and St. Joseph. Buffalo has a large beef-cattle market. Of course all the larger cities are great markets for raw milk and for beef in retail form.

Care of the dairy cow.— All cows deserve better treatment than they receive. They are entitled to the best of treatment, for they give us milk, butter, and cream while they live, and even when they die they give us shoes and robes and coats to keep us warm. Beef, the meat that they yield, is an important article of food.

A good cow is entitled to six things from her master: (1) Kindness; (2) a clean, dry home; (3) plenty of light; (4) pure air; (5) pure water; and (6) an abundance of salt. Every caretaker of cows should see that these conditions are met, as well as see that his cow has plenty to eat.

Every animal in a well-managed dairy herd will be so tame that the owner and attendants can easily catch her in the open lot at any time.

A dog, be he ever so gentle, is of little use in connection with a dairy herd. A club or a whip should have no place in a dairy barn.

Light and ventilation explain themselves. We must supply all the light and the pure air possible. It is not costly to provide light in a stable, neither is it very costly to provide efficient means of ventilation in old stables if the owner is a live, hustling manager with his mind open to the best in his power for the comfort of his animals. All the dairy papers and experiment stations are ready at any time to help and to suggest means of bettering stable conditions, with plans that may be had for the asking. Most of these plans are simple and economical, and farmers are fully capable of putting them into execution.

Cows should be watered at least twice a day. The water should be pure, and, if possible, it should be free from ice at all times of the year. If cows have a place to drink where ice does not form, and if they are watered twice a day, it does not seem necessary to warm the water artificially. It is important to avoid chilling the animal so that she will not have to stand and shiver after drinking. Any system is a "good watering-system" which will furnish pure water and which works so that the cow gets all that she requires at least twice in twenty-four hours.

A cow should be furnished with about one ounce of salt every day. The practice of our best dairymen varies. The writer would suggest feeding each cow about two ounces of salt three times a week, either mixing it in the grain feed or merely throwing it into the manger any time during the day.

If boys and girls, in helping their fathers to take care of the cows, will keep in mind the foregoing suggestions, our State will have not only the largest number of dairy cows, but also the finest, cleanest, and tamest cows in the world.

BIRD BOXES

A. A. Allen

There are many ways of attracting birds to the home or to the schoolhouse, some of which have already been presented to you. We may hang suet in the trees and scatter seeds to attract the winter birds: we may provide food for our summer visitors in case of want and establish drinking fountains and washbasins. But one of the most successful and interesting means at our disposal for attracting the birds is that of building nesting boxes.

Perhaps we have been feeding the winter birds with such success that the chickadees and nuthatches and woodpeckers have ever been with us and we wish to keep some of them all through the spring and summer; or perhaps we wish to attract other summer birds as they come back to us in the spring. The cheery bluebirds, the industrious wrens, and the graceful tree swallows may each be invited to remain about our dwellings by the proper placing of nesting boxes, and if they chance to select our proffered box for their chosen home we may feel well repaid: not only by the beauty and interest that they will bring into our lives, but because in feeding their hungry young they will protect our trees and gardens against the ravages of insects. Having decided to put up one or more nesting boxes, the question naturally arises, what kind of a box to get and where to place it. The object of this article is to put such information at your disposal in the simplest form.

In the first place, many birds that can be attracted in no other way will be attracted by the planting of trees and bushes. We must not expect them to come to our boxes. Other birds will nest about our buildings, if they are given any encouragement in the way of a protected shelf on which to place their nests. These are the robins, phœbes, barn swallows, and eave swallows. The modern barn, with its vermin-proof walls and smooth rafters, provides neither entrance for the swallows nor places for them to attach their nests. The painted boards beneath the eaves are too slippery for the gourd-shaped nests of the eave swallows. The man who builds such a barn little realizes that he is driving away one of the chief protectors of his crops. He should make haste to cut an opening beneath the gable and to nail cleats to the rafters and beneath the eaves, that he may once more avail himself of the services of the swallows. Similarly, cleats or shelves placed about the porch, above the pillars, or in other sheltered corners will provide nesting places for the robins and phœbes and will encourage them to remain with us. These shelves

should be placed less than a foot beneath some projecting roof or other shelter.

The buildings of our forefathers were full of nooks and crannies where wrens and bluebirds liked to nest; the orchards were not so scrupulously pruned, and woodpeckers found plenty of dead limbs in which to drill their holes. To-day we must provide artificial nesting sites to take the place of these natural ones, if we wish to have the birds about us as they used to be.

Some birds, notably wrens and bluebirds, will avail themselves of anything in the way of a shelter which you see fit to put up; while others, such as woodpeckers and nuthatches, are more particular and require something more natural in the form of a hollow limb. The chief difficulty will be not in the construction of the boxes nor in attracting the birds, but in keeping out the English sparrows. These interlopers are ever present and ready to begin building as soon as the box is in place. Needless to say, you do not wish these rascals, but prefer our native birds. There is no sure way of keeping them out except by hanging the box on wires so that it swings freely in the wind. The objection to this box is that it proves less inviting to our native birds, and so should be attempted only as a last resort. One meets with greatest success with boxes placed on exposed poles or in trees, with the opening no larger than is necessary for our native birds: one and a half inch for swallows and bluebirds, smaller for wrens and chickadees.

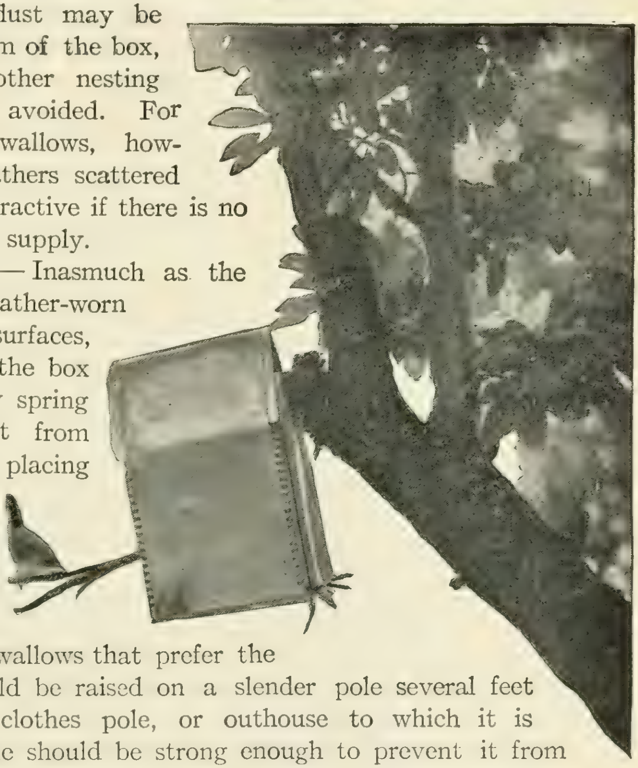
The box.— No money need be expended on this. Old, weather-beaten timber is more attractive to the birds than smooth, painted boards. The best boxes will be made from sections of a hollow limb, covered above and below by weathered boards with a hole drilled near the top of one side. Artificial limbs can be made from bark or by hollowing out solid branches with the bark still attached. Old boxes, or new ones made for the purpose, are next best. For the smaller birds, such as chickadees, wrens, bluebirds, and tree swallows, the boxes should measure not more than 12 x 5 x 6 inches, and they may be considerably smaller to advantage. The ordinary crayon box of the schoolroom is very serviceable, but requires reinforcing with wire or nails so as to withstand the weather.

The box shown in the illustration is a crayon box, with an additional roof of tin from an old can used because of the leaky condition of the box. Cigar boxes and codfish boxes are generally less satisfactory than odorless ones, and all bright surfaces should be avoided. A box with the top or one side hinged is better for observation, but care should be used to keep it permanently fastened.

Old teakettles, tin funnels, and cans of various sorts have been used by some persons with success, but the box is more sightly and usually more attractive to the birds. The opening should be made circular or square,

preferably the former, and toward the top of one side. It should be no larger than the dimensions given above.

If one is not bothered with sparrows, a perch should be provided beneath the opening; but inasmuch as sparrows do not take so readily to boxes without perches as do other birds, it can be removed if necessary. A perch should be placed in the near vicinity, however, on which the birds may alight before proceeding to the nest.



A layer of sawdust may be placed in the bottom of the box, but the use of other nesting material is to be avoided. For chickadees and swallows, however, cotton or feathers scattered near may prove attractive if there is no poultry to furnish a supply.

Placing the box.— Inasmuch as the birds prefer weather-worn materials to bright surfaces, it is well to have the box in position by early spring and thereafter left from year to year. In placing it, three things should be borne in mind: attractiveness to the birds, comfort, and protection. For the swallows that prefer the open, the box should be raised on a slender pole several feet above the fence, clothes pole, or outhouse to which it is attached. The pole should be strong enough to prevent it from swaying in the breeze, and yet sufficiently slender to protect against marauding cats. Sometimes, if squirrels are abundant, it is necessary to place a metal shield about the pole in order to prevent them from climbing to the nest for the eggs or the young. The pole should be near a building, dead tree, telephone wire, or other natural perch. Wrens and bluebirds also may frequent this box, but they prefer to have a tree in the immediate vicinity. Boxes placed seven to twenty feet up in a tree generally prove more attractive to the latter birds, as well as to the chickadees and nuthatches; but care should be used to guard the tree from cats by shields of metal or wire netting. As exposed a position as possible should be chosen for the site, yet one which is more or less shaded from

the sun during the heat of the day. It is better to have the box face toward the south.

Frequently, boxes placed on the house or the school building, below or beside an upper window, prove attractive to wrens, swallows, or bluebirds and are then near enough for observation. These boxes, however, are frequently overrun with English sparrows and are unsuccessful for that reason.

The best results with bird boxes are always obtained by studying the habits of the birds of the neighborhood that nest in holes, and reproducing their nesting conditions as nearly as possible.

LIST OF BIRDS COMPRISING THE SPRING MIGRATION

(Until April 30 — Approximate)

Date of arrival	
Feb. 15–Mar. 10	Purple grackle
	Rusty grackle
	Red-winged blackbird
	Robin
	Bluebird
Mar. 10–20	Woodcock
	Phœbe
	Meadow lark
	Cowbird
	Fox sparrow
Mar. 20–31	Wilson's snipe
	Kingfisher
	Mourning dove
	Swamp sparrow
	Field sparrow
Apr. 1–10	Great blue heron
	Purple finch
	Vesper sparrow
	Savanna sparrow
	Chipping sparrow
	Tree swallow
	Myrtle warbler
	American pipit
Apr. 1–10	Hermit thrush
Apr. 10–20	Yellow-bellied woodpecker
	Barn swallow
	Yellow palm warbler
	Pine warbler
	Louisiana water thrush
	Ruby-crowned kinglet
Apr. 20–30	Green heron
	Spotted sandpiper
	Whippoorwill
	Chimney swift
	Least flycatcher
	* * * * * *
	Black-and-white warbler
	* * * * * *
	Ovenbird
	House wren
	Brown thrasher
	Catbird
	Wood thrush

BOOKS FOR THE RURAL SCHOOL

Alice G. McCloskey

Would it not be possible for the boys and girls in your school to collect $1.05 for the following list of books for the school library? You can take the books home to read in the evening. If you can collect the money, write a letter as follows, enclosing $1.05 in stamps:

To the Owen Publishing Company,
Dansville, N. Y.

Sirs:

Please send me the following books, selected from your five-cent Classic Series:

No. 27 Æsop's Fables
33 Stories from Andersen
200 Child of Urbino
19 The Cotter's Saturday Night
13 The Courtship of Miles Standish
23 The Deserted Village
183 A Dog of Flanders
17 Enoch Arden
14 Evangeline
127 Gray's Elegy Written in a Country Churchyard
20 The Great Stone Face
34 Stories from Grimm
71 Selections from Hiawatha
8 The King of the Golden River
195 Christmas Poems and Stories
184 The Nürnberg Stove
122 The Pied Piper of Hamelin
126 The Rime of the Ancient Mariner
11 Rip Van Winkle
124 Selections from Shelley and Keats
18 The Vision of Sir Launfal

If you cannot buy all the works in the list, send for one or more, enclosing stamps for each at five cents.

Nearly all these books are for boys and girls over ten years of age, but many of the younger children will enjoy them. They will make good reading aloud in the home and good reading aloud at school. The books have paper covers and will need to be handled carefully, but this will be good experience. We know that our boys and girls in the rural schools are going to overcome all slovenly habits, and so you will doubtless be glad to show how well you can take care of these simple books until they have been read by every one in the class.

I think boys and girls in the country should have some reading that is interesting and amusing, if at the same time it gives the education that all good books should give. I am therefore going to suggest that as soon as possible you will try to own a copy of the "Just So Stories" by Rudyard Kipling. This book is published by Doubleday, Page & Co., New York City, and costs $1.20. It is a book that you will like not only while you are young, but throughout the coming years. I have watched with interest the enjoyment of a number of scholarly persons listening to these stories read aloud. Very young children like them. The older folk like them. The next time father or mother wants to buy a book for you, this may be the best one of all. It has a bit of nonsense in it, which is always good if of the right sort. It is a work that gives young persons a taste for good literature.

POULTRY

ALICE G. McCLOSKEY

Long ago many farmers kept poultry from year to year without profit. Many persons now know that in order to be successful in poultry-raising one must become a student of poultry and have knowledge of breeds of poultry, feeding, housing, and the like. It is a most interesting study and many boys and girls in New York State are giving it much attention.

Any one who works with either animals or plants must develop keen observation in relation to them. We would suggest, therefore, that boys and girls in public schools begin to make observations on the poultry

that they have at their own homes or that is on other farms in the neighborhood.

What varieties of poultry are most satisfactory in your community?

How can you tell one variety from another?

Why should one market eggs of uniform size? Why should eggs always be cleaned before sending them to market?

Why do we feed poultry differently when we want to obtain eggs or when we intend to sell the poultry for meat?

Why should henhouses be kept clean?

Why should poultry have plenty of air?

Should a poultry house have any light? Why?

MORE ABOUT POTATOES

ALICE G. McCLOSKEY

Sometime during the year I want every boy and girl to place a potato on the desk and to write to Mr. Tuttle answers to the following questions. In your letter make a drawing of the potato that you have selected.

1. How do potatoes differ in size and shape?

2. How can you tell that the potato is an enlarged part of the stem instead of a root?

3. Ask your teacher how you can find out for yourselves whether there is starch in potatoes.

4. Near which end of the potato do you find the greater number of eyes?
5. On which side of the eye is the "eyebrow"?
6. To what does the "eyebrow" correspond?

BLOSSOMS*

L. H. BAILEY

(FOR OLDER BOYS AND GIRLS)

There are two parts to the common day — the performance of the day, and the background of the day. Many of us are so submerged in the work we do and in the pride of life that the real day slips by unnoted and unknown. But there are some who part the hours now and then and let the background show through. There are others who keep the sentiments alive as an undertone and who hang all the hours of work on a golden cord, connecting everything and losing none: theirs is the full life; their backgrounds are never forgotten; and the backgrounds are the realities.

The joy of flowers is of the backgrounds. It lies deeper even than the colors, the fair fragrances, and the graces of shape. It is the joy of things growing because they must, of the essence of winds woven into a thousand forms, of a prophetic earth, and of wonderful delicateness in part and substance. The appeal is the deeper because we cannot analyze it, nor measure it by money, nor contain it in anything that we make with our hands. It is too fragile for analysis.

I think that this fragile brotherhood with the earth must always have been a powerful bond with men and an infinite resource to them, although I catch little of the feeling of it in the ancient literatures. I think that men must always have responded to the wild rose and to the tenderness of the grass. Certainly we know that men very early began to assemble blossoms about their homes, and to pass on the seeds from friend to friend.

Centuries ago great elaborate books were written about flowers, and the kinds even then were many and some of the forms were marvelous.

*Printed by courtesy of The Magazine FLOWERS.

Worship and praise have centered about flowers and garlands rather than about the fruits that we eat; this marks them to have been considered as of the higher things. All holy and great occasions need them if the occasions are complete. Not a soul but responds to blossoms, even though he knows it not. No soul passes a lily in blow, an apple orchard in the May, a clover field swept with red, or a good garden lying at his feet, but that some reflection of it enters his mind and lodges itself in some nexus of the brain. It would be difficult for any man to imagine a flowerless world; and if he conjured it in his dream he would find himself sitting in some oasis of greenery and bloom.

There is much speculation as to why flowers ever came into the world or of what necessary utility they are to plants. But we are free to accept a fact; and flowers are facts. I think there must be something more than mere utility to the plant that brought blossoms into existence. But why ever they came, they are joyful things and they are parts in the journey in life.

To know a flower well and to grow it well are more than botany and gardening. The songs of birds, the feel of winds, the flow of streams, the appeal of flowers, are so real that we are likely to forget them or to lose them; but the flowers excel them all in the ease and completeness with which we may adapt them to personal needs and incorporate them into a process of life.

LETTERS FROM GIRLS AND BOYS

DISTRICT 11; TOWN OF HAMDEN; DELAWARE COUNTY

DELHI, N. Y., November 27, 1912

Dear Mr. Tuttle:

We received your leaflet yesterday and were very glad to get it. I have read every word in it. I think it is very interesting this month.

I am especially interested in the locust tree as we have a large one in our yard. It is very old and there is not a dead limb on it. I think its blossoms are lovely, and they are so fragrant. How long will a locust tree live? We are going to get a little locust tree on our school yard next spring. They are very easy to get to grow. They grow up very quickly, do they not?

We were very sorry when the summer birds all went south, but we are watching the winter birds. We are going to hang a piece of suet on the schoolhouse window to see the birds come for it.

This fall I watched the flowers along the roadside and found the everlasting bloomed the longest.

What beautiful moonlight evenings we are having now! How pretty the little stars look down from the sky on the snow!

I will close for this time, and I am very anxious to get our next leaflets.

Sincerely yours,

EDITH L. PEARCE

DISTRICT 4; TOWN OF DELAWARE; SULLIVAN COUNTY

JEFFERSONVILLE, N. Y., November 11, 1912.

Dear Mr. Tuttle:

We received the Cornell leaflets a short time ago and we were very glad to get them and thank you for same. We enjoy reading and studying them very much.

Our teacher's name is Mr. Edward C. Neiger. We have had him for three terms and I like him very much. Our schoolhouse is a frame building, and it stands about fifty feet from the road. We also have a large school yard. It has two wild apple trees on it and twelve maple trees. We intend to graft the apple trees in the spring.

Our teacher asked us to bring shovels, hoes, and pickaxes to grade the school grounds, which we did, and the grounds look very nice now. We also have a new stone walk from the schoolhouse to the road, which was recently laid. And while we were working at the school grounds the girls washed the windows, swept the floor, scrubbed and cleaned the desks.

We got a new bookcase this fall, and we are going to get a new slate blackboard, a new globe, and a new flag. Our bookcase has two hundred and forty volumes in it. We had some potatoes planted that were badly eaten by the grubworms. Do you know of any way to get rid of them? If so, kindly write and let me know. I have a black and white cow at home. She was three years old last spring. I also have a little garden. It has ten bushes of potatoes, a few bushes of corn, some carrots, and a few flower plants.

I will be twelve years old the twenty-fourth of January next.

We expect to have a corn exhibit and then I will write you again.

I expect to write three letters and get the picture that you offer.

Very truly yours,

WINFRED SCHMIDT

DISTRICT 10; TOWN OF STONY CREEK; WARREN COUNTY

WEST STONY CREEK, N. Y., December 2, 1912

Dear Mr. Tuttle:

I am a girl of twelve and this is the first time I ever wrote to you, but I thought I would write a little.

I live on a farm in the country, ten miles from town. I am going to school every day now. My teacher's name is Mrs. I. Van Auken. There are six children in our school, three boys and three girls.

I hope you will have time to answer my letter so I will not be disappointed. I am not working for the picture, but to get a new friend.

I am going to try to write every month hereafter.

There are two orchards on our farm, both of apples.

I am interested in drawing and I hope I will become a painter some day. I have studied drawing two terms.

Well as I cannot think of any more, will close with best wishes from a true friend,

BEATRICE CODNER

LETTER TO GIRLS AND BOYS

Dear Girls and Boys:

TO-DAY is the first sharp gray day that we have had and it is full of the promise of winter, which will be at its height when you read this letter. Far away across the valley I can see the high hills with a light mantle of snow, so light that it almost disappears as I watch. Soon these hills of field and forest will be covered with a warm, thick blanket, underneath which the tender buds and shoots will rest in safety waiting for the spring to come and for the flowing sap to start their growth.

The days are now shortest of all the year. We get up before the sun, and at night lamps must be lighted ere supper time comes. But boys and girls do not mind. Warmly dressed, cheeks rosy with the cold, there is always time for a last slide down that long, shining hill in the gathering dark, or to put the finishing touches on that strong fort of snow which is to withstand the attack of the enemy next morning. At last it is time to go in, and a merry, breathless group shakes off the snow, removes caps and coats and boots and leggings, hovers for a minute near the warm kitchen stove, and finally settles down around the bright table for the evening meal.

After supper has been cleared away and a fresh log thrown on the open fire, there comes a time when most boys and girls like to curl up in a cozy chair and read. I wish that every one of you might form the habit of reading a little each day. Even if it is only for ten or fifteen minutes, this will amount to many hours in the course of a year. Books are the best of comrades. There are many good things written for boys and girls, and we want to help you to know what these are; for, when you do take time to read, should it not be something worth while? Look on page 959 and see what Miss McCloskey has said about some little books that all of you may own.

I must tell you about a visit that I made some weeks ago. I had set out for a long walk into the country. It was late in November, and as I walked briskly along the open road I was interested to notice how many flowers were still in bloom. I gathered a small specimen of each kind

and put it in my pocket. After some time I came to a district school, knocked, was warmly welcomed, and found a seat among the little first-grade children. There were twenty-two girls and boys in the school. After I had been there a while, the teacher asked me to talk to them. I was not sure that I had anything worth while to say, but in my pocket were the flowers; so I asked how many had watched the flowers blooming far into the fall and what flowers they were. One boy said " daisy " and a girl said " dandelion."

" Both right," I said, " but surely there are others."

No one knew, so I told them that I had ten or twelve in my pocket, and that as I took each one out we would study it and name it, putting the name on the blackboard. All were eager to see, and our list grew longer and longer. Besides the daisy and the dandelion, we had red, white, sweet, and alsike clover, yarrow, wild carrot, narrow-leaf plantain, teasle, wild mustard, and yellow melilot. As it was near closing time, we all went out of doors for a few minutes and into a big field back of the school, where we found many of these flowers growing and were able to study them in their complete and natural form. Thus we learned something new, and we shall long remember that little time together.

Some day I may visit your school. Should I do so, there would be much for us to talk about, especially those things that you are studying this year: the nuthatch, hen, cow, potato, potato beetle, lady beetle, and locust tree. Each of these will unfold new wonders to those who study it carefully, and you should not let the year go by without becoming familiar with one or more of them. Always keep in mind that the truest knowledge is to be gained by examining the object itself. In studying the hen, for example, let one boy bring a hen to school for the day. Have some sort of a screened box to keep her in, and observe her appearance, general shape, color, kind of comb; notice how she eats, drinks, scratches, preens her feathers; listen to her different songs; in short, learn all that there is to learn by observing intelligently.

I am getting many, many letters every day from my young friends, and am most pleased to know of the great number of interesting and useful things that you are doing. We have received an ear of corn from many schools, showing that they celebrated Corn Day. If your school had Corn Day exercises and you have not yet sent the prize ear of corn, do not fail to send it at once. The November leaflet contains information about this.

It is our desire to make the leaflet for boys and girls as interesting and instructive as possible. We should like to publish some of the actual experiences that you have with the nature work. Will you not write me fully whenever anything of special interest happens? Perhaps other

children would be glad to know about it. We should also like to have photographs of your school showing the improvements that you have made, or of something that you have added to give life and interest, such as window-boxes, a nature-study corner, a terrarium, an exhibit, a tree-planting, or bird-houses. By the way, when you build a bird-house, try to make the roof water-tight, because if the house gets wet inside it does not dry out readily as does the nest in the tree and it is not so pleasant for the birds. Do not fail to read the article by Mr. Allen on page 955.

Only a word more: I want all the boys and girls who receive these leaflets and who are my friends to become each day more bright and happy and kind and generous. And I want every one of you to honor his or her word, to feel responsibility. One of the finest things in the world is a person who can be absolutely depended on to do a piece of work, do it without watching, and do it well. You want to be such a person. It takes patience and thought and care, but it is well worth while.

In March I shall send another letter. Meantime, do not hesitate to write to me freely about yourself, and about all the things that interest and occupy you.

Your friend,

Edward M. Tuttle

CERTIFIED MILK AND PASTEURIZED MILK

H. E. Ross

Some of the older boys and girls have asked what is meant by certified milk and pasteurized milk.

Certified milk is milk that is produced under a legal contract between a dairyman and a medical milk commission. The medical milk commission is usually appointed by the medical society of a county. Certified milk is milk that is produced under the most cleanly conditions possible. There is a popular belief that certified milk is milk that has gone through a certain process, but this supposition is incorrect. The conditions under which certified milk must be produced vary somewhat with the different commissions having the matter in charge, but the commissions all have regulations that are more or less similar. For example, most of the commissions require that the cows shall be tuberculin-tested, and that the milk shall be cooled to a certain temperature as soon as it is drawn from the cow. The employees working around the barn and dairy must be in the best physical condition and must

wear clean, white, overall milking-suits, and in almost all certified dairies a clean suit is used for each milking. The milk must be bottled, and it cannot be sold after it has reached a certain age. The men are required to wash their hands after milking each cow.

The primary object of certified milk is to obtain a milk that can be prescribed by physicians in much the same manner as are drugs and medicines. Milk is one of our best and cheapest foods and is used extensively in feeding infants and invalids. Physicians have had considerable difficulty in obtaining milk that was produced in a cleanly manner, and this has given rise to the production of certified milk. From the conditions required, one can readily see that it costs considerably more to produce certified milk than to produce ordinary market milk, and for this reason a high price is usually charged the consumer.

Pasteurized milk is milk that has been heated to a temperature high enough, and for a long enough time, to kill all pathogenic, or disease-causing, germs, the milk then being cooled down to a temperature of 50° or less. The main object in pasteurizing milk is to kill disease-causing germs, chiefly the germs of tuberculosis. There are different temperatures and different lengths of time required for pasteurizing milk, but usually, in cases when pasteurizing is required, the rule is that the milk shall be heated to a temperature of 145° F. for at least twenty minutes, and usually one minute in time is subtracted from the twenty minutes for every degree above 145° F. to which the milk is heated.

There are two important arguments against pasteurizing milk: in the first place, frequently the work is not done thoroughly; and in the second place, the practice tends to allow the milk-producer to follow unclean methods and then have these methods covered up. If, for example, the cow puts her foot in the pail, many unscrupulous milk-producers will not keep this milk out of the regular supply, knowing that the germs entering the milk through the mishap will be killed by the process of pasteurizing. However, the harmful products of these organisms would still remain. Another objection to pasteurization is the fact that the lactic-acid organisms which cause the souring of milk, and therefore tell us when it is not fit for infants or invalids to use, are killed more readily than are other organisms usually found in milk. Milk may therefore appear to be perfectly wholesome and normal, and yet at the same time it may contain many of the organisms that would be harmful to the human system, particularly to infants and invalids. Many of the stomach disorders from which infants suffer in summer might be traced to milk that has been pasteurized. If, however, the milk supply is very bad and it is not possible to improve it in any other way, and the process of pasteurization is carried on properly, it may be a good thing. Some cities require that all milk be pasteurized.

CORNELL

Rural School Leaflet

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AGRICULTURAL CONTESTS

Prize-Winners, Dutchess County Corn Contest, 1912

FOR
DISTRICT SUPERINTENDENTS
AND FOR
BOYS AND GIRLS
WHO ENTER
AGRICULTURAL CONTESTS

IMPORTANT NOTICE *

The purpose of this bulletin is to help in organizing agricultural contests for boys and girls in order that they may find the development that comes through interest in farm experiences and practices. Wholesome competition should be encouraged. In order to avoid the exploitation of children for any agricultural movement, we strongly urge that all contests along this line be conducted on an educational basis under the direction of the superintendent of rural schools. Many a seemingly successful contest has done harm instead of good. Each individual child who signs an entry blank should be taught to feel the responsibility of completing his piece of work. Hundreds of children enter contests, but often a few only have completed work to present when the contest closes. The aim in agricultural contests should be to develop men and women as well as a better agriculture. If the contests are so conducted that local interest holds each child to his work, encourages him to exhibit the results of his labor, and teaches him to be a good loser if he fails to win a prize, the benefit will be permanent in the community. There is real honor in winning a prize, but the child should be taught to look beyond the prize to the greater honor in accomplishing the best piece of work of which he is capable. Every adult who has to do with this work must feel his responsibility for the character of the boy or girl. Agricultural contests may be immoral in influence; on the other hand, they may be made one of the strongest factors in the redirection of country life. Some things to be kept in mind are:

1. That in New York State the educational supervisory district will make the best unit for an agricultural contest; the district superintendent will be the person best fitted to take the leadership. He knows the teachers, he knows the school children, he keeps in touch with advanced ideas for the education of boys and girls.

2. Small beginnings are best in agricultural contests. The important thing is that every child should finish the piece of work which he begins. It might be best for a district superintendent to make his first experiment with one township, choosing the township that promises the most earnest support in demonstrating the value of the work. This will do much to awaken interest in every township because the work will doubtless show quality in the exhibits, and this is always of more value than is quantity.

3. All philanthropic and social organizations, Young Men's Christian Associations, granges, business men's associations, women's clubs, and the like, and all public-spirited individuals can be most helpful by cooperating with the school organization to develop a permanent guidance toward a better outlook to country life among the young folk.

PERMANENT DIRECTION

SIMPLE BEGINNING

WHOLESOME COMPETITION

DEVELOPMENT OF BOYS AND GIRLS THROUGH AGRICULTURE AND DOMESTIC SCIENCE, THUS INCREASING EFFICIENCY IN RURAL FOLK AND DEVELOPING A MORE FUNDAMENTAL GROWTH OF COUNTRY-LIFE INTERESTS

* A table of contents for this leaflet is given on page 1064.

FOREWORD

The Editors

This leaflet has been prepared to meet a special demand. During the summer of 1912 a number of district superintendents conducted agricultural contests; many more gave the matter much thought with a view to taking up the work another year, and the College of Agriculture received numerous requests for help in organizing and conducting such contests, as well as for subject-matter to be used by the contestants.

After carefully considering the matter, both in regard to what has been done and what may be done in future, we have arrived at several conclusions which it may be well to present at this time:

1. It appears to be highly desirable that there be a somewhat uniform system of agricultural contests in the State as a whole. Should the local contests prove successful they will undoubtedly lead to contests covering a wider territory; and if there is to be any possibility of various local units competing in a central contest, they must of necessity be fundamentally similar in character.

2. The district superintendent is the logical leader of these contests, and the supervisory district the natural territorial unit New York State is particularly fortunate in its school organization. The supervisory district should prove large enough to afford a good contest and not too large to be under the general direction of one man. Moreover, in all but three of the rural counties of the State there is more than one supervisory district, and this makes possible a contest among the districts of a county. District contests will lead to county contests, which will ultimately lead to a state-wide contest.

3. In working out a county contest, or even a district contest including the county seat, there is no more powerful agent of cooperation than the

county fair. The fair organizations everywhere appear to be ready to furnish a place for the exhibition of the results of the contest, and to aid in the matter of prizes.

4. It is the universal testimony of those who have conducted agricultural contests that there is no other one enterprise that does so much to awaken the interest of the community at large and to create a feeling favorable to the promotion of better educational practices in all lines. The activities of the contest are close to the people. They can watch its development and its results, not only in the production of the crop but also in the broadening and strengthening of the children.

5. Every local organization should be connected with the contest in some way or other. The district teachers, the grange, the Young Men's Christian Association, the business men's organization, and all other groups within the district can help. The more closely and personally it is possible to follow each contestant, giving advice and encouragement, the better will be the final result both economically and educationally. As with everything else, it is possible to have a contest that will be of little fundamental value, or it is possible to have a contest that will arouse interest and wholesome activity throughout the district. The essential factor is to follow the work between the signing of the entry blanks and the exhibit of the finished product. In this, local cooperation is vital. One man cannot do it all nor does he want to. Each person and each organization should contribute something — time, materials, or money. Then each will have an interest in the outcome. The leader should merely guide the efforts in order that greater efficiency may be produced.

In response to the many requests for help in connection with agricultural contests, we have asked several of the members of the faculty of the College of Agriculture to prepare material on the organization and conduct of such contests. The material thus obtained has been compiled and is included in this leaflet. Sixteen possible contests are outlined. We anticipate that for the first year it will be found advisable to conduct but one contest in any district. Later, possibly, two or more contests can be handled during a single season. Enough crop contests have been offered to make possible a rotation from year to year with the same contestants using the same land. Such a rotation may be planned to give knowledge of actual farm practices and will thus serve as an additional educational factor joining the series together. It is very essential to have more than a single season's experience result from the crop-growing contest. The great power of this work lies in keeping the children interested and in working with them for a number of years along fundamental lines.

Every constructive effort in education goes beyond its actual time and place of presentation. Agricultural contests possess large possibilities

in the way of good working methods, intelligent business practices, cooperative intercourse, increased community spirit, and the development of the individual. Therefore they are worthy of serious consideration and faithful trial.

CROP-GROWING CONTESTS

E. G. MONTGOMERY AND E. R. MINNS

At present there are a number of agricultural contests that have been organized in the State for the purpose of growing some crop to be exhibited later in the season at a central place.

Inquiry has come to hand asking for information about contests of this kind, how they should be organized and conducted, what kinds of crops to use, what sort of records to keep, and problems in connection with the exhibition, the premium list, and the general program.

Contests of this kind are not new, for agricultural competitions have been conducted for many years among farmers and occasionally among farm boys. However, the first systematic efforts to organize contests in a general way began in some of the Western States about ten years ago. Various plans of organization were adopted, but, in general, the attempt was made to organize the boys of a county for the purpose of growing some kind of crop for competitive exhibition at a central place in the fall.

In the Western States corn has been well adapted for this purpose and is generally used, although in some cases other crops, such as potatoes, sugar beets, and other vegetables, and in a few cases small grains, have also been grown for contests.

The movement has had a very rapid development in the Southern States in the last few years, under the direction of agents from the United States Department of Agriculture. The county is usually the unit of organization. In some cases the prize-winning material from the county contests is sent on to the state contests later in the season. In some States as many as 15,000 boys are now organized and each boy is growing

some kind of crop for his contest. In the South as well as in the West, corn has been thought well adapted for contest work and is the principal crop used. In New York State corn is not such an important crop, and it is probable that potatoes would be of more general interest than corn. Oats might well be used in some localities.

Up to the present time various organizations have undertaken contests in different parts of the State. In some cases the district superintendent has been the leader; occasionally the county secretary of the Young Men's Christian Association has directed the work; or some public-spirited citizens or a group of business men have organized the contests.

The general interest in these contests seems to indicate that the time is at hand when there should be a uniform system throughout the State. The state school system is an organization which is admirably adapted for the work of conducting crop-growing contests. In the Western States this has been found very successful, the county superintendent in each county usually acting as the leader in organization. In New York State it would seem that the rural school supervisory district already organized would be the logical unit, and the district superintendent the person to act as leader.

As soon as the movement develops in several supervisory districts in one county, it may be desirable for the district superintendents to unite and make the whole county a unit. Then, if the interest grows, there should be in time a state contest, in which all the prize-winning material from the county contests could be entered. It would add much interest to local contests if it were known that the best material would be forwarded to a state contest. In order to make this possible, the crop contests should be standardized so that the prize-winners could meet on common ground in a county or state contest.

The work of organization should begin several weeks before planting time, so that all the contestants who wish to enter can make their entries and arrangements for growing the crop. After the district superintendent has worked out his plans, he should call together his teachers and have them present the matter to the boys in their districts and encourage them to enter the contest. The event should be advertised in local papers and discussed at grange meetings.

When all the entries have been made, some active interest on the part of the leader will be needed until harvest time. For this work there should be a fund for correspondence and like expenses. Would not the local granges help in this? The interest and support of grangers will be most helpful to the leader. It will be well to consult them as to the time and place for the exhibition, program, prizes, and other matters relating to the contest.

PLANS FOR CONDUCTING THE CONTESTS *

We assume that the rural school supervisory district shall be the unit for the crop-growing contest. Potatoes, corn, oats, clover, vegetables, flowers, and fruit are recommended as possible crops. The choice of crop and the variety of the same should be left to each district to decide. In making the decision the leader should carefully study local conditions, in order that the first contest shall be one that will have general interest and success.

The first contests held are usually merely an exhibit of selected samples, such as ten ears of corn or a peck of potatoes. (Page 980.) This kind of contest has considerable merit and is usually simple and easy to carry out. If no other kind can be organized, much interest can be developed by this simple contest. Each contestant chooses the variety that he wishes to grow and the place in which he wishes to grow it, the only restriction being that he perform practically all the labor of producing his exhibit with the exception of team labor. Ordinarily, when the contestant enters he signs a form stating that he wishes to enter the contest. It is also customary to have his district teacher sign the form with him, and one or both of his parents. This form usually states that he will perform all the work according to the rules prescribed. The following form may serve as a model and is applicable to all contests:

APPLICATION FOR ADMISSION TO THE POTATO-GROWING CONTEST

OF THE

SECOND SUPERVISORY DISTRICT OF TOMPKINS COUNTY

I, ..., hereby request to be enrolled as a contestant in the potato contest. As certification of my intention to carry out faithfully the conditions of the contest and to exhibit the result at the time and place to be designated, I herewith sign my name in the presence of witnesses.

.....................(Contestant)

WITNESSES

..............................(Teacher)

..............................(Parent or guardian)

* These plans and the following paragraphs on prizes and programs will apply to all rural contests.

Another type of contest has become very popular, and wherever possible it should be adopted since it is much more educational than the above. (Page 1017.) In this contest the prize is awarded not only for *quality* but also for *economic production.* In some cases, prizes have been offered for the largest yield per acre and for no other consideration. Such contests, however, have not been altogether satisfactory, as the largest yields may be raised in a very unpractical way, the grower using very large amounts of manure and increasing his yield regardless of cost. A more satisfactory plan is the one used in the Southern States, in which yield, cost of production, quality, and story of crop-raising are to be considered. The basis of award for a corn contest of this kind is as follows:

Greatest yield per acre	30 per cent
Best showing of profit on investment	30 per cent
Best exhibit of ten ears	20 per cent
Best story of crop production	20 per cent

The contestants are judged according to their comparative standing in all the four points, and the one scoring the highest total is declared the winner. In addition each contestant keeps a complete record of his work. Sample blanks for these records will be found under each contest in Group II.

PRIZE DAY PROGRAM

Very often the exhibition for the entire district or county is held at one place A good-sized hall is engaged for the purpose, and suitable tables and racks provided for the exhibit. Additional prizes are often offered for decorative articles made from economic plants — such as mats, hats, and the like, made from corn husks — or for maps and signs made by using grains of different colors. Such exhibits are attractive.

On prize day everything should be in place by nine o'clock in the morning, so that the judges will be able to finish their work by noon. In many places a picnic lunch can be held, the parents coming with their children and staying all the afternoon. The program may take place at a convenient hour and, if possible, should be given in the building in which the exhibition is held. It may consist of music, essays, and recitations by local talent, and conclude with a talk by the person who judged the exhibits or by the district superintendent. It may be made the occasion for extending the organization and laying out plans of work for another year.

PRIZES TO BE OFFERED

Every boy and girl should be taught the real meaning and value of a prize, and that a realization of work well done is the true reward of effort.

As a general thing it is not necessary nor advisable to offer large prizes. A few donations of useful articles can usually be provided. In many districts breeders of live-stock or poultry are glad to donate an animal or a fowl for the first prize. This is one of the most appropriate prizes that can be given. In other cases, prizes of merchandise are usually very easy to obtain if solicited. Whenever cash can be subscribed it has always been found to be the most satisfactory prize.

It is not wise to limit the prizes to two or three winners, as practically every one who has entered the contest has made earnest effort and should have some recognition. If cash can be provided, it has been found a good practice to pro-rate it among those who have made a creditable exhibit. If exhibits have been scored in a numerical way, pro-rate the money among all who have attained a standing above 60 points. This will probably make it possible for one half of the contestants, or more, to share the money and it has been found more satisfactory than putting all the money into two or three prizes. Ribbons make simple and inexpensive prizes and in many cases are about all that will be needed in addition to a small amount of cash for pro-rating. The ordinary custom is to use blue ribbons for the first prize, red for the second, and white or yellow for the third. The date and occasion can be printed on the ribbon and this recognition of merit is nearly always appreciated.

A prize of considerable value offered for grand sweepstakes is one of the best advertisements, and is a means of keeping up interest in the contest during the year. If this particular prize can be provided early in the season, even before the contests are announced, and placed before the contestants as a grand prize, it will stimulate much interest; but there should always be a large number of small prizes, so that a large percentage of those entering may receive at least some recognition. The large sweepstakes prize might take the form of a trip to some point of interest, such as the State Capital or the State College of Agriculture. Such an award has real educational value.

ASSISTANCE FROM THE COLLEGE OF AGRICULTURE

THE EDITORS

THE district superintendents will each receive a copy of this leaflet, in order that they may learn what material is available from the College.

It will be seen that the contests have been classified under three general heads: 1. The crop contests that are based merely on the quality of the product without relation to the economic value of the crop. This group should be open to both boys and girls up to the age of sixteen. In this group are included contests with corn, potatoes, vegetables, flowers, and fruit trees. 2. The crop contests that are based on the economic value of the crop as well as on the quality of the product. Probably this group will be best suited to boys between the ages of sixteen and twenty-one. In this group are included contests with corn, potatoes, oats, clover, vegetables, and small fruits. Note especially that before starting a contest in this group the charges for labor must be standardized. (Page 1017.) 3. The contests especially designed for girls. In this group will be found two classes, divided according to the ages of the contestants. Each class contains contests in bread-making, canning, jelly-making, and sewing.

We hope that live-stock contests will be conducted in the State in the future. Boys and girls take much interest in the care of calves, lambs, and poultry. Material for such contests will be published another year.

The contests as outlined should not be considered as standard in every particular. The district superintendent should modify them so as to suit the conditions of his district, but it is highly advisable that the fundamental principles involved shall be incorporated in all contests held in the State.

Whenever necessary, specimen forms of application and record blanks have been given. These will serve as a guide. A district superintendent organizing a contest should have the necessary blanks printed with the essential local information.

It has seemed advisable to include in the same leaflet the material on the contest organization, on the rules of the various contests, and on the working methods. The leader should have a knowledge of the entire field, and it will be valuable for the contestant to see how the whole contest is organized and conducted as well as to make his own contribution. A copy of this leaflet will be available to each contestant on the order

of the district superintendent. After organizing a contest and securing the entries the superintendent should advise the College as to the probable number of leaflets needed, and the leaflets will be sent to him in bulk for distribution. The material contained herein is sufficient for several contests; those receiving the leaflet should therefore be cautioned to preserve it carefully, since it will not be possible to supply more than a single copy to one person.

As the contests develop, many questions will undoubtedly arise as to both organization and subject-matter. The College is not able at present to handle a large correspondence in this field, even if it were advisable. Local interest and local unity will be strengthened if the contestants look to their leader for all information. The College is ready to cooperate with the leader at all times. In this way the district superintendent will become better acquainted with the State College and with the men in the various departments, he will soon acquire a fund of information that will enable him to answer more and more questions without reference, and he will strengthen his hold on the district. The College, in correspondence with two hundred and seven persons instead of with many thousands, will be able to give more prompt and efficient help.

As a brief summary: The district superintendent plans a contest, has the application blanks printed, advertises the contest, and procures the entries. He then applies to the State College of Agriculture for the required number of copies of this leaflet, which he distributes among the contestants. He instructs the contestants to address to him all questions relating to the contest. Those questions that he finds himself unable to answer should be referred to the Editors of the Cornell Rural School Leaflet, who will see that they are answered by the proper authorities. It would seem that this plan, if carried out, should meet all difficulties promptly and with the greatest efficiency. Thus the State College can be of assistance at the opening of the contest.

At the close of the contest, and in regard to the matter of exhibits and prizes, there is opportunity for further direct cooperation between the district superintendent and the State College. To make awards on prize day an experienced judge should be found. If the prize day programs in various parts of the State can be arranged on such dates that a circuit may be followed, the College of Agriculture will furnish an experienced person to judge a limited number of contest exhibits The best time to fix the dates for such a series of prize days will be between October 15 and November 15. In order to secure this assistance from the College of Agriculture, tentative dates for exhibitions should be submitted early in the previous August, so that a satisfactory circuit may be decided upon by the judge and the date for each exhibition in the circuit finally fixed by him before the first exhibition.

GROUP I. CONTESTS FOR BOYS AND GIRLS UNDER SIXTEEN YEARS OF AGE

Fairview Garden School, Yonkers, New York

1. How to Grow Prize-Winning Ears of Corn

RULES FOR THE TEN-EAR CORN CONTEST

1. Every boy or girl entering this contest must be under sixteen years of age and a resident of New York State.

2. Each contestant must obtain the consent of parent or guardian and enroll with the district superintendent before beginning any work in the contest.

3. In each contest the same *type* of corn (pop, flint, or dent) must be used by each contestant, but a contestant may choose the particular *variety* to plant.

4. Each contestant must do all the work connected with the growing of the corn after the plowing and harrowing are done, but all who can are urged to perform these operations also.

5. Each contestant must keep a complete record of the work done on blanks furnished by the district superintendent. This record must be signed by two responsible persons who know that it is correct, and must be submitted on prize day with the ten ears of corn exhibited.

CORN-GROWING RECORD

Made by........................ ..... Post-office address..........................
(Contestant's name)
Age..............years

This record has been kept by myself in connection with growing ten ears of ...... corn for the contest of the Second Supervisory District of Tompkins county.

1. Kind of soil on which corn grew...
2. Kind of crop last grown before corn..
3. Kind of manure used, if any..
4. When manure was applied................ ....
5. Date of plowing....................Depth of plowing....................
6. Kind of harrow used for making seed bed.................................
7. How many times harrowed ... .rolled...........floated ....
8. Kinds of fertilizer used ....How much.... ....
9. Variety of corn planted..
10. Where the seed corn was grown..
11. What percentage germinated in the seed tester........... ....
12. Date of planting.................. . Method of planting.................

....

13. Give dates on which corn was cultivated...................................

....

14. Hoed...
15. When did first tassels appear......................... ....
16. When was first ripe ear noticed....................................... ....
17. How many stalks grew to maturity..
18. Date of harvesting...
19. Number of ripe ears harvested...
20. What damage, if any, was done by insects, birds, or animals................
21. Where the ears of corn were kept after harvesting.........................
22. Date of selecting ears for the exhibit......................................
23. What have you learned by growing this corn...............................

....

....

....

Name.......................................
(Contestant sign here)

Date........................

I do hereby swear that to the best of my knowledge and belief the rules of this contest have been faithfully carried out by............................,and that the above record is correct.

....

....
(Signatures of two other persons)

CULTURAL DIRECTIONS

E. R. Minns

Preparation.— The first step in growing prize-winning ears of corn is the choosing of soil that is adapted to growing corn. Corn is a plant that delights in a warm climate and in a rich mellow soil that becomes warm fairly early in the spring. Corn will grow well on sandy- and gravelly-loam soils, provided they do not become too dry in summer. Such soils should have enough humus, or decaying vegetable matter, so that they will hold some of the rain that soaks into them. A clay- or silt-loam soil may grow good corn if it is kept porous and well drained.

The previous crop that grew on the ground chosen is important in corn-growing. Usually the best preparation for corn is to plow up a meadow or pasture field. To plow under a clover sod is considered ideal. The decay of the roots and stems of clovers and grasses makes food for the corn plants, and the humus formed helps hold the moisture in the soil and makes the soil easy to cultivate. It is well to remember that a field of sod ground may contain white grubs or cutworms, both of which are enemies of corn plants. If grubs are known to infest the ground, it is not wise to use it for growing corn.

Generally the best corn grows where barnyard manure has been applied at some time during the year before the corn is planted. Corn is better able than are many other farm crops to use fresh barnyard manure when plowed under. Some farmers use well-rotted manure applied to the fields in spring; others use fresh barnyard manure, applied either in spring or during the previous autumn and winter. It is best to apply it before plowing in any case. The corn roots will find their way to the manure and there will be fewer weeds to destroy. Ten to twenty loads per acre is a moderate application of manure, but more may be used if it is in a good condition for even spreading. A heavy coat of coarse manure, plowed under in spring, may do more harm than good to the corn by drying out the soil too much.

Some farmers plow ground for corn before winter begins. On rather loose, porous soil this is probably better than spring plowing, as it gives the furrows an opportunity to settle and become well moistened. For moist loam soils, spring plowing seems to be better for corn. It should be done when the ground is dry enough to crumble well as the furrow is turned. When plowing for corn, one should try to make a seed bed that is mellow enough to suit the rapidly growing plants, and at the same time compact enough to contain moisture sufficient for their needs.

After plowing for corn in spring it will often be well to use the roller for pressing down the newly turned furrows. Then harrows of some kind

should be used to make the seed bed level, fine, and loose to a depth of about three inches. Rolling will not be needed on land plowed the previous autumn. On fields that are a little lumpy the roller may be used with good results just before marking and planting.

Commercial fertilizers can be profitably used on corn under some conditions. If barnyard manure cannot be obtained before plowing and the soil is not rich, good corn may sometimes be grown with the aid of two to five hundred pounds per acre of fertilizer containing nitrogen, phosphoric acid, and potash. Some successful farmers use one to two hundred pounds per acre, even though the field may be manured before plowing. This fertilizer should be mixed with the soil, either in the row or on each side of the row, but it is best not to have the seed touch the fertilizer in the ground. Homemade fertilizers, such as wood ashes and droppings from poultry, are sometimes used in corn hills in order to make the corn grow.

Planting.— For growing prize-winning corn the very best variety that you can find should be used. A variety of corn that has been grown in the neighborhood for many years by some careful farmer will give better results than will one which may come from a distance. Sometimes a better variety can be bought in another State or county, but it is best to find a home-grown variety if possible. The seed corn used should be tested in order to see whether it will sprout vigorously. This should be done before planting time. Even a good variety of corn may fail if the seed has not been properly cured and stored during the winter.

In planting corn one should try to cover the kernels with fine soil just deep enough so that they will be surrounded by sufficient moisture to make them sprout and begin to grow. One inch is usually deep enough. In very loose soils one and one half or two inches may be required in order that the seed may reach the needed moisture. Pressing down the soil around the hill of corn may help bring the moisture nearer the surface and thus sprout the corn faster. The width of rows and the distance apart of hills or stalks in each row must be varied to suit the kind of corn that one is growing. Small varieties of pop corn and flint corn do not need wide rows. If rows are three feet apart, that will give ample room for cultivation. Good corn is sometimes grown in rows not more than thirty inches apart. Where weeds are likely to be troublesome, it is thought best to plant corn in hills. Four or five kernels should be planted in each hill. If the hills are rowed in two directions the work of cultivation is made more effective. Large varieties of corn are usually planted in rows forty or forty-two inches apart, with hills three feet or more apart in the row. It has been found by experiment that better ears are produced when the stalks stand apart in the row than when they

are grouped closer together in hills. Many acres of corn are sown in drill rows each year. This gives single stalks a chance to grow by themselves in the row. For growing the best ears the stalks should stand not nearer than one foot apart in the row. In planting corn for exhibition it is wise to plant more seed than is necessary to make a stand of plants. Some stalks will be stronger than others and the weak ones can be thinned out. Four to eight quarts of seed corn will be required to plant an acre, depending on the size of the kernel and the variety of corn used.

Cultivation.— When the corn has sprouted and begins to appear in the rows, the weeds also are growing and it is time to cultivate thoroughly. Many corn-growers use a weeder for stirring the surface of the soil before the corn begins to appear. The weeder is intended to kill weed seeds as fast as they sprout, preventing them from becoming rooted in the soil. The weeder does not cultivate deep enough to tear out the corn that is sprouting in the ground. Cultivation between the rows of corn helps to warm the soil, and that makes the corn grow faster. When the corn is very small and its roots have not grown very far out into the row, the horse cultivator can be made to dig deeper than the corn is planted. This will loosen the soil, which may have been packed down in fitting and planting the field, and later the corn roots will grow out into this soil more readily. Until corn tassels it may be cultivated every week with benefit, but as it grows taller and its roots spread the cultivation should be shallower and farther from the rows, so as not to disturb the roots. Hand-hoeing is necessary only to kill the weeds that grow in the row where the cultivator does not reach them.

When corn has been planted thickly enough to require thinning, the weaker plants should be pulled up when the corn is a few inches high. It is wise to wait until the corn is too large for crows to pull or cutworms to destroy. Of course these enemies should be kept away if possible. For pop corn and flint corn planted in hills, three or four stalks should be left in each hill after thinning. For dent or flint corn it is best to leave not more than three stalks in the hill. These should be the strongest and most vigorous plants.

Harvesting.— When the corn begins to show yellowing husks and leaves, this is a sign that it is ripening. It is usually harvested at this stage, but for prize-winning corn the stalks should be left standing until the ears are very ripe unless damage from weather or from animals is likely. When the stalks are dead and the ears hang down in their ripe husks, it is time to harvest the corn. Husk all the ears and spread them out carefully, so that you can choose those that you wish to exhibit.

The ears of corn from which the prize-winners are to be selected should be chosen from the entire crop at harvest time. It will be wise to choose more than ten ears and hang them up indoors where they may cure

perfectly and be safe from mice until the time for the exhibition. In choosing the ten ears for the exhibit, one must have in mind what constitutes a perfect ear of corn of that type. The score card gives us a means of measuring each ear of corn in order to see how perfect it is. The ten ears most nearly approaching the perfect score are the ones that should be exhibited. Below is a sample score card that can be used in choosing ten ears of dent, flint, or pop corn, and that should be used by the judge who scores the exhibits and awards the prizes:

SCORE CARD FOR EARS OF CORN

1. Maturity and soundness	35
2. Uniformity	20
3. Weight of ear	15
4. Shape of ear	10
5. Shape of kernels	10
6. Tip of ear	5
7. Butt, or shank	5
Perfect score	100

1. Maturity means ripeness. It can be told usually by the appearance of the ear of corn and by the way the ear feels. A mature ear will have the kernels firm on the cob. It will not feel moist in the hand. The cob will not be limber nor the kernels shriveled or shrunken so that the ear will bend very readily under pressure. Only ripe, undamaged ears of corn should be exhibited.

2. Not all the ears of one variety will be exactly alike, but there should be uniformity in color of the kernels, color of the cob, and shape and general appearance of the ears. If mixed with some other variety of corn the ears will lack this trueness to type. If the variety of corn used has not been well bred, it may be hard to find ten ears that are nearly alike.

3. The weight of an ear of corn can be judged by holding it in the hand and observing its size. One would not expect an ear of a small variety of corn to weigh as much as an ear of a larger variety, but in order to be a good ear it should be heavy for its size. This usually means a large percentage of grain to cob.

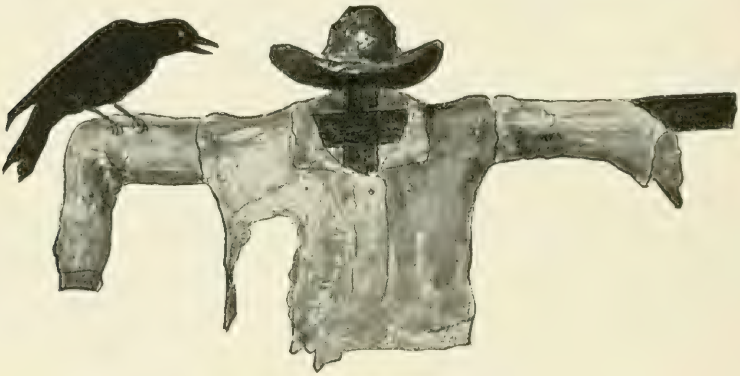
4. The shape of the ear will depend much on the variety of corn grown. The length of the ear should be well proportioned for that variety. Moderately long ears, well filled, are more desirable than short, thick ears of the same variety. An ear that tapers very strongly toward the tip is usually deficient in the shape of its kernels and in its weight.

5. Different types of corn have differently shaped kernels. The best dent corn usually has a somewhat wedge-shaped kernel, but not a pointed one. Flint corn has broader kernels than those of dent corn. Pop corn

may have either pointed or rounded kernels, according to the variety. In general, the shape of the kernel should be such that the rows fit closely together on the cob and do not leave spaces between them.

6. An ear with the tip end of the cob bare is not a good one to show. Good ears of corn will have the tip well covered with kernels.

7. Ears of dent corn should have the butt of the ear well filled; and a moderate-sized shank is desirable. Some kinds of flint corn have a tendency to grow very large shanks, and the butt of the ear is enlarged so that it is not properly covered with kernels of corn. This is objectionable. Ears of pop corn frequently have butts that taper, and the shank is weak so that the ears may drop off the stalk when ripe. Frequently the best ears of corn will have butts that are symmetrical with the rest of the ear.



2. How to Grow a Peck of Prize Potatoes

RULES FOR THE PECK-POTATO CONTEST

1. Every boy or girl entering this contest must be under sixteen years of age and a resident of New York State.

2. Each contestant must obtain the consent of parent or guardian and enroll with the district superintendent before beginning any work in the contest.

3. In each contest any variety of potatoes may be chosen by a contestant, but a contestant must not plant more than a peck of seed potatoes for the contest.

4 Each contestant must do all the work of growing the crop after plowing is done, but a contestant may use all the advice and suggestion that it is possible to get from more experienced persons.

5. Each contestant must keep a complete record of the work done on blanks furnished by the district superintendent. This record must be signed by two responsible persons who know that it is correct, and must be submitted on prize day with the peck of potatoes.

POTATO-GROWING RECORD

Made by........................ Post-office address........................
(Contestant's name)

Age............years

This record has been kept by myself in connection with growing a peck of potatoes for the contest of the Second Supervisory District of Tompkins county.

1. Kind of soil in which potatoes grew....................................
2. Kind of crop last grown before ground was chosen for potatoes.............
3. Kind and amount of manure used...
4. If not applied directly for potatoes, when was manure last applied..........
5. Kind of sod or green manure plowed under, if any.........................
6. Was the ground plowed more than once for potatoes........................
7. Date of plowing...
8. How many inches deep was the plowing.....................................
9. Describe the work of fitting the ground after plowing......................
....
....
10. How much fertilizer used, if any..
11. What kind of fertilizer used..
12. Variety of potatoes planted....................Quantity planted..........
13. Where were the seed potatoes grown......................................
14. Were seed potatoes treated for scab fungus................................
15. How were they cut before planting..
16. Date of planting...
17. Describe the method of planting...
....
18. Date of first appearance of potato plants..................................
19. Date of first cultivation..
20. How many times cultivated..
21. Dates of hoeing.........................hilling.....................
spraying...
22. What kind of spray was used...................Why...................
23. Date when potatoes began to ripen..
24. Date of digging..
25. How many bushels harvested...
26. Date of selecting potatoes for exhibit.....................................
27. What have you learned by growing this crop of potatoes.....................
....
....

Name...............................
(Contestant sign here)
Date......................

I do hereby swear that to the best of my knowledge and belief the rules of this contest have been faithfully carried out by......................and that the above record is correct.

....

....

(Signatures of two other persons)

CULTURAL DIRECTIONS

E. R. Minns

Soil.— For growing good potatoes one should choose a soil that is mellow and that will be somewhat moist during the growing season. The ideal soil is a sandy loam. Just as good potatoes may be grown on a gravelly-loam soil, but stones large enough to interfere with cultivation are objectionable. Good potatoes are often grown on shallow soils, if such soils are rich enough and do not dry out badly in midsummer. Generally a deep, rich, mellow soil is the best in which to grow prize potatoes.

Preparation.— Previous treatment of the soil is rather important. If a crop of clover has been grown the year before and the sod turned under in the autumn to be replowed in the spring, one is likely to have the best conditions for a potato crop. Some growers prefer to plow grain stubble for potatoes, but in any case it is well to enrich the soil by manuring it the year before or by applying a good coat of well-rotted barnyard manure before plowing in the spring. For growing early potatoes a heavy coating of manure is needed. Late potatoes are often grown without heavy applications of manure. On soils that are not rich in humus it is wise to grow a cover-crop on the ground during the previous winter, to be plowed under for green manure rather early in the spring. If rye or rye and vetch have been grown in this way and plowed under, one is likely to have a better potato crop than if the ground has been left bare all winter.

If the soil is deep the plowing may be as deep as ten inches. This will give the potatoes a deep seed bed and plenty of feeding-ground for their roots. If the soil is shallow it will not be wise to plow deeply and mix the raw subsoil with the more fertile top soil just before planting. The advantage of plowing in the previous autumn and replowing in the spring is that the sod or other vegetable matter plowed under in the fall is largely mixed with the soil, and the seed bed is made more mellow by the second plowing in the spring.

As soon as the spring plowing is done, one should try to make the seed bed fairly fine without compacting it too much. Disk harrows, spring-tooth harrows, and drags are the best tools to use in preparing the seed bed. It is not wise to roll, or float, the potato field, nor is this necessary if the plowing and the previous preparation have been done thoroughly.

Fertilizers.— The use of commercial fertilizers on potato crops is very important in some parts of New York State. Five to fifteen hundred pounds of commercial fertilizer, rich in nitrogen and potash and containing some phosphoric acid, are profitably used by many farmers. The use of these fertilizers is especially desirable on sandy land that is poor in

mineral plant-food; but fertilizers will not make a good crop if the soil is poor in humus and the plowing and fitting are not well done.

Seed.— It is very important to have good seed potatoes if one wishes to grow prize-winning tubers. Seed potatoes should be sound, should not have been allowed to sprout in storage, and should be as free from disease germs as it is possible to have them. If their skin shows signs of scabbiness, the seed potatoes had better be treated with formalin solution in order to kill the scab germs before planting. The whole tubers should be soaked for one hour before cutting, in a solution of one pint of formalin to thirty gallons of water. The best seed potatoes are those of moderate size. Small potatoes may come from hills in which all are small, and they will tend to grow small potatoes. Very large or overgrown potatoes are objectionable, because they do not cut well into seed pieces and they are not wanted on the market. In cutting potatoes for seed a tuber should be cut into pieces weighing two ounces each. If the tubers are of the right size, cutting lengthwise into halves, thirds, or quarters should produce pieces of the right size. It is best to have a part of the bud end on each piece.

Planting.— There are different ways of planting potatoes, all of which are good. They may be dropped by hand into furrows five or six inches deep, and covered by hand or with a horse-drawn cultivator. The most careful work may be done in this way. If a few inches of dirt are first drawn over the pieces of potato they will begin growing promptly, and more dirt can be drawn over them as soon as the sprouts appear. Potato-planting machines are made to open the furrow, drop the seed pieces at proper distances, and cover to the full depth desired, in one operation. Some potato-growers prefer to plant potatoes in hills and cultivate in two directions. This enables them to kill the weeds more easily. Each grower should plant in the way that seems to give the best results in his own vicinity.

Cultivation.— When potato pieces are planted the sprouts and roots are sent out at the same time. When the sprouts appear above ground the roots are not very long. In order to keep the soil rich and mellow near the roots, it is well to cultivate deeply at this time. Later cultivations should be more shallow and not so near the roots as the plants increase in size. Some growers use a weeder to stir the soil in the potato rows and kill the weeds before they are well started. The weeder and cultivator can be used alternately to good advantage for several weeks. When the new potato tubers begin to sprout in the ground, some growers draw earth up to the potato plants in order to hill them up. If there is danger of wet weather, or if the soil is shallow so that deep planting is not allowable, this practice gives good results.

Spraying.— Potato vines are subject to the attack of potato beetles, which often appear when the plants are very young and not yet growing rapidly. Spraying in order to poison these beetles and their larvæ should be begun as soon as it is seen that they are doing damage. Other foes of the potato plant are fungous diseases, the worst of which is known as late blight The spraying can be done so as to protect the potato plants from both insects and diseases at the same time. Bordeaux mixture is the best remedy for potato blight; and paris green, when added to bordeaux mixture at the rate of one pound of paris green to fifty gallons of bordeaux mixture, will usually prevent the beetles from doing much damage The spraying should be done often enough to keep the leaves of the potato vines coated with the sprayed materials. Some growers spray for blight as many as five, or even seven, times; others spray two or three times during the season. In a season when the development of late blight is increased by warm, wet weather, it may be necessary to keep on spraying frequently and thoroughly until nearly digging time In some seasons very good potatoes can be grown without any spraying whatever.

Digging — For a small potato patch, hand-digging with a spading fork or a potato hook is probably the best practice. Care should be taken not to injure the tubers that have formed in the ground. Where potatoes ripen naturally, one should wait until the vines are dead before digging. If the vines are killed by frost or by an attack of blight it may be necessary to dig the potatoes before they are well ripened. If possible, they should be dug when the ground is dry enough so that the soil falls from them in handling. The time of digging is the best time to choose specimens for the exhibit Choose more than a peck and store the potatoes at once in a cool, dry place where little or no light can reach them. Choose specimen tubers that are of uniform size, shape, and color, and are free from any blemishes. The following score card should serve as an ideal to have in mind in choosing these tubers:

SCORE CARD FOR POTATO TUBERS

1. Soundness	25
2. Shape of tuber	25
3. Uniformity	15
4 Size of tuber	10
5. Texture of tuber	10
6 Shape of eyes	10
7 Condition of skin	5
Perfect score	100

EXPLANATION OF THE SCORE CARD

1. Soundness means freedom from disease, injury, or immaturity.

2. Potatoes vary much in shape, but each variety should have its own characteristic shape. The best potatoes are oval in shape and fairly smooth.

3. The potatoes chosen should be uniform in size, shape, and color and should be true to name.

4. Potatoes of uniform size, neither too large nor too small, are the ideal kind to exhibit.

5. A good potato will have a firm, hard texture. It should not be elastic nor tough when pressed between thumb and finger. A potato of good texture will crack and break when cut with a thick knife.

6. The most desirable kind of eyes on a potato are those not very deep. Shallow eyes cause less waste in peeling and therefore will score higher.

7. The prize-winning potato will have a clear, smooth skin. If the potato is immature the skin may be peeled or broken. A russeted skin does not make so attractive a potato as does a smooth skin.

3. How to Grow Prize-Winning Vegetables*

RULES FOR THE VEGETABLE CONTEST

1. Every boy or girl entering this contest must be under sixteen years of age and a resident of New York State.

2. Each contestant must obtain the consent of parent or guardian and enroll with the district superintendent before beginning any work in the contest.

* The vegetable contest offers opportunity for a wide variety of prizes. They may be given solely on the basis of the entire collection of vegetables exhibited by each contestant, or they may be given also for the various kinds of vegetables within the collection.

3. Each contestant must grow the variety of each vegetable decided on by the leader at the opening of the contest.

4. Each contestant must do all the work of growing the vegetables after the plowing and harrowing are done, but a contestant may use all the advice and suggestion that it is possible to get from more experienced persons.

5. Each contestant must keep a complete record of the work done on blanks furnished by the district superintendent. This record must be signed by two responsible persons who know that it is correct, and must be submitted on prize day with the vegetables exhibited.

6. Each contestant shall exhibit six specimens of each of five vegetables chosen from the following list:

Beets
Cabbage, late
Carrots
Corn, sweet
Cucumbers
Onions
Parsnips
Squash
Tomatoes
Turnips

INSTRUCTIONS TO JUDGES

In making the awards, judges will take into consideration the following points:

1. All specimens exhibited should be of the size that is most demanded by families, therefore not exceedingly large. The six specimens of each variety should be of uniform size. 10 points.

2. The six specimens of each variety should be of uniform shape. Odd-shaped specimens or monstrosities should be thrown out. 10 points.

3. The six specimens of each variety should be of the same color. 10 points.

4. The six specimens of each variety should be of a uniform smoothness, free from blemishes. 10 points.

5. The six specimens of each variety should be attractive in appearance, well washed or cleaned, and with nothing to detract from their desirability. 15 points.

6. The vegetables should be arranged for exhibition in a way that is attractive and instructive, so that the whole looks inviting. 25 points.

7. Record. 20 points.

VEGETABLE-GROWING RECORD

Made by........................ Post-office address..........................
(Contestant's name)

Age............years

This record has been kept by myself in connection with growing five vegetables for the contest of the Second Supervisory District of Tompkins county.

(Draw a plan of garden to scale on the back of this blank. Give particulars as to distance between rows and kind of vegetable in each row.)

1. Kind of soil..
2. Kind of crop last grown before vegetables..................................
3. Kind and amount of manure used, if any..................................
   When applied..
4. Date of plowing....................Depth of plowing...................
5. How was the ground fitted for sowing..................................
   ....
6. Where was the seed obtained..................................
7. Planting: Give dates for each vegetable..................................
   ....
   ....
   ....
   ....
8. Cultivation: Dates..
   Tools used..Have you watered the garden........................How much.................
   ....When..................................
9. Were the plants thinned...................Which ones.................
   ....To what distance........................
10. Were any plants transplanted....................Which ones............
    ....When.....................
11. Harvesting: Give date and yield for each vegetable....................
    ....
    ....
    ....
    ....
12. What damage, if any, was done by insects, birds, or animals................
13. Date of choosing vegetables for exhibit..................................
14. What have you learned by growing these vegetables......................
    ....
    ....

Name..................................
(Contestant sign here)

Date......................

I do hereby swear that to the best of my knowledge and belief the rules of this contest have been faithfully carried out by........................and that the above record is correct.

....

....
(Signatures of two other persons)

CULTURAL DIRECTIONS

Albert E. Wilkinson

Many boys and girls are not familiar with the principles of vegetable-gardening. We shall therefore present here some of the essential factors necessary to success in gardening.

Planning the garden.— Before the actual gardening is begun, a well-drawn plan should be made by each boy and girl. Draw your plan to a scale — that is, let $\frac{1}{4}$ inch on the paper represent 1 foot in the garden. Using this scale on a garden 25 by 50 feet, we should have a drawing that would be $6\frac{1}{4}$ by $12\frac{1}{2}$ inches.

With the same unit of measure represent the rows as they should be made, always remembering that for each foot in the garden you will use one fourth of an inch on the paper. Consult the table, page 1001, for the space between the rows of vegetables as well as for the distances apart of the plants in the rows.

As the required varieties are given for boys and girls under sixteen years of age, the work of planning will not be quite so hard as for the older boys. The latter must plan for at least fifteen varieties, and by skillful work they can include in their plans others that are not mentioned.

In planning a garden it is very important that vegetables of a tall habit of growth should be so placed that they do not shade those of a low habit of growth. This will give all the plants the best exposure to sunlight.

Seeds.— After the plan is drawn on paper the young gardener must decide how much seed will be needed. The planting-table will help in this. It has a column showing the amount of seed required for 100 lineal feet. If the row in the garden is only 50 feet long, the seed required will be one half the amount named in the table. It is always best to order more seed than is actually required.

When the quantity of seed is known it should be ordered from a reliable seed house. Consult a neighbor who has a successful garden.

Testing seed.— Choose ten average seeds of one variety. Provide a box eighteen inches long, twelve inches wide, and at least two inches deep and fill it with good garden soil. Make shallow lines in this soil one inch apart, of a depth about two to four times the diameter of the seed to be planted. Place the ten average seeds that you have chosen in the first of these shallow marks, or furrows. Mark the box at the end of the row on the wood, so that you will know the variety of seed that is planted in that row. Choose ten more samples of another variety, and plant in a second row. Continue in this way until all the varieties of seed procured have ten samples planted in the box. Cover the seed with soil and press the soil firmly with the palms of your hands. Sprinkle about a pint of water over the soil and put the box in a place near the

stove or in a sunny window where it will have a fair amount of heat. Water the soil during the next two weeks. Record the date of planting the seed, and each day record the number of plants that show above the soil. If at the end of two weeks nine of the ten seeds in the first row have shown above ground and are still healthy and green, the percentage of growth will be 90; if eight, 80; if six, 60. If the test shows less than 60 per cent, more seed will have to be used in the actual planting of the garden in order to obtain the number of plants desired.

The above is the most valuable test of seeds, as it shows not only those seeds that will sprout well but also those that under fair conditions will grow in the garden. Seeds that show a high percentage in this test will be profitable to plant.

Location.— If mother or father will give you your choice of a place for your garden, choose a piece of land that has been under cultivation for two or three years. If this land slopes slightly toward the south and is of a loamy, not clayey, soil, it will answer your purpose. If the land is near a hen-yard it will be well either to fence the garden or to plan to keep the hens in their yard.

Staking the garden.— With pieces of wood stake the garden corners on the land to be used. These stakes will serve to show where to spread manure, or where to plow, spade, or harrow.

Manuring.— If good, well-rotted stable manure is available, spread a generous coating of it on the garden. It is doubtful whether too much can be applied. Some of the best gardeners use as much as three or four inches of well-rotted manure spread over the ground.

Plowing or spading.— If the ground is plowed it should be done after the manure is spread, and should be to a depth of six or eight inches. It is better, however, to use a spade or a spading fork, which will turn the soil to a greater depth than will the plow. With such a tool in the hands of a boy who will use his head as well as his hands in his work the manure can be placed at a very good depth.

Smoothing.— Harrowing can follow plowing, and fine smoothing can follow harrowing. If horse power is not used the hand rake will be the most serviceable tool. The rake can be used for breaking all lumps, as well as for leaving the soil level and smooth.

Permanent staking.— After raking, permanent stakes can be driven at the corners of the garden in place of the temporary stakes first used. A nail should be driven in the top of the southeast corner stake, and exact measurements from this stake to the other stakes should be made, nails being placed in the tops of the other stakes where they are found by measurement to be needed. The use of these nails will help greatly in future exact measurements for planting.

Planting.— The time of planting given in the planting-table must be used with common sense and varied so as to suit the conditions of weather and other local factors. It will serve merely as a guide. The young gardener should ask advice of a successful grower of vegetables in his neighborhood.

In planting seed, the rows in the garden should correspond to the rows as planned on the paper. Measurements from the nearest stakes at both ends of the rows should be taken. A garden line or some other means should be used for keeping the rows straight.

The table given on page 1001 will serve as a guide in planting the seed but no one can be taught gardening from a printed page. Consult your parents, your teacher, or your district superintendent.

A furrow should be opened to the required depth with a hoe, which, as stated above, should be guided by a line or mark. The seed should be spread along the bottom of this furrow, and then dirt should be filled in over the seed and pressed down by walking on it.

If there is a planting-machine on the farm, such as a Planet Jr., Iron Age, Columbia, or the like, it may be used in planting.

Transplanting.— If tomatoes or other plants are raised in a hotbed, cold-frame, or seed bed, they should be removed with the largest amount of root surface possible and placed in the garden in the straight row planned for them, at the proper distance apart, in the following manner: With a trowel dig a hole larger than the plant roots need, fine the earth, set the roots of the plant in this fine earth slightly deeper than they grew, cover them with dirt, press hard, fill in more dirt, pressing now and then, until the level of the soil is reached. The plant will then be transplanted in such a way that it will have the best opportunity to grow.

Thinning.— If the plants come up too thickly they should be thinned according to directions given in the table under the heading "Distance apart of plants in row." This is necessary in order to give the remaining plants the space that they require for the best growth.

Cultivating.— Two things are necessary for good cultivation — keep them in mind: first, absence of weeds; second, the surface soil loose at all times. These conditions can easily be maintained by means of the hand, the hoe, and the rake. Pull out the weeds, hoe around the plants, rake after hoeing.

Watering.— If the season is exceptionally dry, water may be necessary for success in obtaining good growth. Hose, watering-can, or pails can be used. However, good culture from the beginning is the most important factor in maintaining a water supply.

Insects and diseases.— Insects can be controlled somewhat by hand-picking them when seen. Diseases can be controlled to some extent by keeping the plants in a thrifty, constantly growing condition, by giving good culture, by watering, and by adding manure dissolved in water, much diluted

CULTURAL METHODS FOR THE DIFFERENT VEGETABLES

Beets.— The garden beet may be grown in any good soil, but rich sandy loam will give the best results. Sow the seeds three quarters of an inch deep — no deeper — in drills twelve to fifteen inches apart. When the plants are three to five inches tall, thin them until there are five or six plants to every foot of row and about two inches between the plants. Beet thinnings make good greens. As a rule, each so-called seed contains more than one real seed. This may account for the fact that beets come up so thickly sometimes. Beets for winter storage should not be sown until the latter half of July.

Cultivation should be given rather frequently. As the beet is a surface feeder, only shallow cultivation should be practiced.

For exhibition pull the beets carefully and wash them clean. Show samples of uniform size, color, and shape.

Cabbage (late).— The seed of late cabbage should be planted in May or June in a seed bed, such as a spent hotbed, a cold-frame, or a specially prepared bed. Plant in rows four inches apart, with the seeds about half an inch apart in the row. The depth of planting should be one fourth to one half inch. When the seedlings are five to six inches tall they can be transplanted to the rows in the garden, spacing them two feet between the rows and two feet between the plants. If the cabbage is to be grown from seed in the garden, it may sometimes be advisable to sow three to six seeds for each plant desired. When the plants are five inches tall, all but the best one may be taken out. Better care is generally given to the plants under the first method.

The soil for late cabbage should be a heavy soil, not so rich as is required for early cabbage and with more moisture than the latter needs.

Shallow, clean culture should be given at all times. Slight freezing does not injure cabbage; however, the plants should not be subjected to repeated freezings.

If green cabbage worms appear, hand-picking is a good method of destroying them.

For exhibition purposes the heads of cabbage should be very solid, perfect in shape, and as large as possible; all cabbages shown should be of uniform size.

Carrots.— Carrots grow best on a sandy loam. The seed is sown rather thickly in drills, or rows, twelve inches apart, in May or June. The seed is covered about half an inch deep. Sometimes radish seeds are planted with carrots, in order to mark the row for the carrots and to help break the soil for the carrot plants that have difficulty in starting. When the plants are four or five inches tall they are thinned so that

there is one and one half to two inches of space between each two carrot plants in the row.

Shallow, clean culture must be given for the best results.

For exhibition purposes the roots should be carefully dug and washed clean. Only uniform samples should be shown.

Corn (sweet).— Sweet corn should be planted on fairly rich land; a good loam soil will give satisfaction. Plant the seed in rows thirty inches apart, five or six seeds being planted in a so-called "hill," the hills being twenty-four inches apart in the row. Later, thin so that the three strongest and best stalks remain in each hill. The seed should be planted not deeper than an inch; half an inch is better. Cultivate often and keep down the weeds. Corn roots are surface feeders, therefore cultivation should be shallow. Remove sucker growths that come out around the base of the stalk.

Cucumbers.—A rather rich, moist but not wet, sandy loam is the best soil for cucumbers. Cucumber seedlings are very easily injured by cold, even when no frost occurs, and the seed should not be planted until the soil is warm. Sow the seed about half an inch deep — never deeper than one inch — in hills four feet apart each way. A shovelful of well-rotted manure or a small handful of fertilizer, worked thoroughly into the soil under each hill, in addition to the regular manuring of the land, will give the best results. The additional manure will give the plants a very good start, making them vigorous and healthy. The cucumbers may also be planted in drills, or rows, six feet apart, thinning the plants to twelve inches apart in the row.

A small, yellow-and-black striped beetle attacks the lower part of the stem and the underside of the leaves, often destroying great numbers of young plants. If only a few hills are grown, a satisfactory remedy may be found in covering the plants with a box frame having fly-screening or mosquito-netting nailed over the top. Later this box is removed and put away for the next year. On a larger patch air-slaked lime or wood ashes may be used, and also poisons if properly applied.

As cucumber diseases are common, bordeaux mixture may have to be applied several times in order to protect the plants. A vigorous, thrifty plant is less likely to become diseased than one that is not strong.

Cucumbers require frequent shallow cultivation until the vines spread over the ground. After this, pulling out weeds seems to be the only culture needed.

If it is desired to keep the vines in good bearing condition, no fruit should be allowed to ripen on them. In harvesting, cut the stem so that one quarter to one half inch remains on the cucumber; by so doing the cucumber will keep longer and sell better.

Onions.— A rich sandy loam, containing plenty of humus, is a good soil for onions. This vegetable has been grown very successfully on the muck lands of New York State.

The seeds are planted in rows, or drills, twelve inches apart. They should be planted not deeper than one half to three fourths of an inch. Onions grown for exhibition should be thinned to four or five plants for each foot in the row.

For very large or very early onions, it is an advantage to plant the seed in hotbeds, transplanting to the rows in the field when the onion seedlings are six to eight inches tall, being sure to have a large number of roots with each seedling.

Onions require frequent shallow cultivations, with persistent attention to weeds. This must often be done by means of hand-weeding.

In early fall the tops of the onions should droop over and die and at this time the onions should be pulled. Allow them to cure for a short period by lying on the ground. Then cut off the dead tops and store the bulbs in crates in a well-ventilated place.

Onion sets may be planted instead of seedlings, or they may be used as a short-season crop with some other vegetable, as tomatoes.

There are several kinds of onion sets, as the Multiplier, or Potato, onion; the Top, or Tree, onion; Shallots, Cibol, and other kinds.

When placed on exhibition the outer dried skin of the onion should be removed. Exhibit onions that are uniform in size, color, shape, and the like.

Parsnips.— Parsnips require a rich loamy soil; a deep loam is best, so that the long root can develop fully. Plant the seed about half an inch deep in rows fifteen to eighteen inches apart. Radish seed planted with the parsnips helps break the surface soil and marks the rows. Thin the plants so that five or six parsnips remain for each foot in the row.

Good clean culture is necessary for the best results with parsnips. The roots can be dug late in the fall and stored for winter use; freezing in the soil improves the flavor. The parsnip can be left all winter in the ground and dug in the spring.

For exhibition, great skill is required in digging in order to obtain the full-length root without injury. The roots should be washed clean. Samples of uniform size, shape, and color should be exhibited.

Squash.— A good loamy soil will meet the requirements for growing squash. Plant five or six seeds of a bush variety in hills three by three feet, using a good forkful of well-rotted manure under each hill. Stir the soil frequently at first. After the vines cover the ground cultivation is no longer necessary. The weeds should be pulled.

For late squash the hills should be spaced eight by eight feet instead of

three by three feet. Cultivation is necessary at first; or a crop, such as spinach, radishes, or lettuce, may be grown in the space between the plants. Later the squash vines will entirely cover the ground. When the squash plants, both late and early, are eight to twelve inches tall, thin to three plants in a hill. Larger and better results will be obtained by allowing one late squash on each vine.

For squash bugs treat as mentioned under "Pumpkin." (Page 1040.)

Tomatoes.— Start the seeds in the hotbed and transplant to the garden when all danger from frost is past. Be very careful not to injure the roots in transplanting since the top is not cut back and growth will be retarded if many roots are destroyed. The young plants should stand in rows three feet apart. Support the vines by means of stakes, using one stout stake and two cross-arms, or any preferred method for each plant. Cut back the vines if they grow too much to leaves and stalks.

Sandy loam in good condition, with an application of manure plowed under, will produce the best tomatoes. A little rotted manure spread on the soil near the plant, if sprinkled with a pailful or two of water now and then after the fruit is set, will help to produce fruit that is smooth and of good color.

For exhibition choose only tomatoes of uniform size, shape, and color.

Turnips.— Turnips require a rich soil, sandy or gravelly, and may be grown as either an early or a late crop. For the former, sow the seed in rows eighteen inches apart early in the spring. Later, thin the plants to about six or seven to the foot. For late turnips the seed is sown in rows eighteen inches apart on land from which some earlier crop has been removed in June. Thin until there are only three or four plants to each foot of ground. Clean culture and a good soil mulch are required. The turnips are fairly hardy and withstand the first light frosts in the fall.

Pull the turnips, cut off all lateral or side roots, and wash clean. Exhibit specimens that are uniform in shape, size, and color.

PLANTING TABLE FOR VEGETABLES

Kind of vegetable	Seeds required for 100 feet of row	Distance apart of rows (hand cultivation)	Distance apart of plants in row	Depth to plant seed	Time for planting in open ground
Beans, bush, green	1 pt.	18 in.	5 to 8 plants per foot	$\frac{3}{4}$ in.	May to July
Beans, bush, wax	1 pt.	18 in.	5 to 8 plants per foot	$\frac{3}{4}$ in.	May to July
Beets	2 oz.	12 to 15 in.	5 to 6 plants per foot	$\frac{1}{2}$ to $\frac{3}{4}$ in.	April to August
Cabbage, late	$\frac{1}{4}$ oz.	24 in.	24 in.	$\frac{1}{2}$ in.	May to June
Carrots	1 oz.	12 in.	6 to 7 plants per foot	$\frac{1}{2}$ in.	May to June
Corn, sweet	$\frac{1}{4}$ pt.	30 in.	24 in., hills	1 in.	May to June
Cucumbers	$\frac{1}{2}$ oz.	4 ft.	4 ft., hills	1 in.	May to July
Lettuce	$\frac{1}{2}$ oz.	12 to 15 in.	10 to 12 in.	$\frac{1}{2}$ in.	April to September
Onion seed	1 oz.	12 in.	4 to 5 plants per foot	$\frac{1}{2}$ to $\frac{3}{4}$ in.	April to May
Onion sets	1 qt. sets	12 in.	4 to 5 plants per foot	1 to $1\frac{1}{2}$ in.	April to May
Parsnips	$\frac{1}{2}$ oz.	15 to 18 in.	5 to 6 plants per foot	$\frac{1}{2}$ to $\frac{3}{4}$ in.	April to May
Peppers	$\frac{1}{8}$ oz.	18 in.	15 in.	$\frac{1}{2}$ in.	May to June
Pumpkins	$\frac{1}{2}$ oz.	8 ft.	10 ft., hills	1 in.	May to July
Radishes	1 oz.	12 in.	10 to 12 plants per foot	$\frac{1}{2}$ in.	March to September
Spinach	1 oz.	12 in.	6 to 7 plants per foot	1 in.	Early in spring, or in August
Squash, bush	$\frac{1}{2}$ oz.	3 ft.	3 ft., hills	1 in.	April to June
Squash, late	$\frac{1}{2}$ oz.	8 ft.	8 ft., hills	1 in.	April to June
Tomatoes	$\frac{1}{8}$ oz.	3 ft.	3 ft.	$\frac{1}{2}$ to $\frac{3}{4}$ in.	May to June
Turnips, early	$\frac{1}{2}$ oz.	18 in.	6 to 7 plants per foot	$\frac{1}{4}$ to $\frac{1}{2}$ in.	April or July
Turnips, rutabaga	$\frac{1}{4}$ oz.	18 in.	3 to 4 plants per foot	$\frac{1}{2}$ to $\frac{3}{4}$ in.	May to June
Watermelons	1 oz.	8 ft.	8 ft., hills	1 in.	May to June

4. How to Grow Prize-Winning Flowers

RULES FOR THE FLOWER CONTEST

1. Every boy or girl entering this contest must be under sixteen years of age and a resident of New York State.

2. Each contestant must obtain the consent of parent or guardian and enroll with the district superintendent before beginning any work in the contest.

3. Each contestant must grow the variety of each flower decided on by the leader at the opening of the contest.

4. Each contestant must do all the work of growing the flowers after plowing or forking the soil is done, but each may use all the advice and suggestion that it is possible to get from more experienced persons.

5. Each contestant must keep a complete record of the work done on blanks furnished by the district superintendent. This record must be signed by two responsible persons who know that it is correct, and must be submitted on prize day with the exhibit of flowers.

6. Each contestant shall exhibit six blooms of each of any five of the flowers in the following list:

Ageratum	Nasturtium
Alyssum, sweet	Pansy
Aster, china	Phlox
Balsam	Sweet William
Candytuft	Salvia
Cockscomb	Snapdragon
Larkspur	Stock
Marigold	Verbena
Mignonette	Zinnia

INSTRUCTIONS TO JUDGES

In making the awards, judges will take into consideration the following points:

1. That the blooms of each variety are of uniform size. 20 points.

2. That the blooms of each variety are of uniform, or regular, construction, so that there is little or no difference as far as petals, calyx, stem, and leaves are concerned. 20 points.

3. That the arrangement of the blooms for exhibition is attractive and instructive. 40 points.

4. Record. 20 points.

FLOWER-GROWING RECORD

Made by........................ Post-office address............................
(Contestant's name)

Age............years

This record has been kept by myself in connection with growing five flowers for the contest of the Second Supervisory District of Tompkins county.

(Draw a plan of garden to scale on the back of this blank. Give particulars as to distance between rows and kind of flower in each row.)

1. Kind of soil..
2. Kind of crop last grown before flowers..................................
3. Kind and amount of manure used, if any...............................
4. Date of plowing or spading...................Depth...................
5. How was the ground prepared for sowing.................................
   ....
6. Where was the seed obtained..
7. Planting: Give dates and depth of each kind...........................
   ....
   ....
   ....
   ....
   ....
8. Cultivation: Dates..
   Tools used...Have
   you watered the garden...................When....................
   How much...
9. Were the plants thinned...................Which ones..................
   ....
   To what distance..
10. Were any plants transplanted...................Which ones.............
    ....When...
11. Give a description of the blooming of each kind of flower, with dates, abundance, color, etc...
    ....
    ....
    ....
    ....
    ....
12. What damage, if any, was done by insects, birds, or animals...............
13. Date of choosing flowers for exhibit...
14. What have you learned by growing these flowers...........................
    ....
    ....
    ....

Name...................................
(Contestant sign here)

Date..............................

I do hereby swear that to the best of my knowledge and belief the rules of this contest have been faithfully carried out by........................and that the above record is correct.

....

....
(Signatures of two other persons)

CULTURAL DIRECTIONS

Albert E. Wilkinson

Preparation for a flower-garden contest will give pleasure to many persons during the summer and autumn. Choice selections from the great list of flowering annuals, well arranged, will make one of the attractive places on the farm or home grounds. To take a neglected spot and by means of flowering plants to transform it into a place of beauty is well worth while.

Every boy and girl should read carefully the written outline given for work in the vegetable garden (page 994), as the principles given under " Planning the garden " and " Cultural methods " apply equally to the successful raising of annual flowers.

Planning.— The flower garden requires as much care in planning as does the vegetable garden. By following the table given on page 1009, plants of the height and color desired may be grown. By careful arrangement, making the tall plants a background for the low-growing plants, a satisfactory result will be obtained. Carefully selected combinations of colors will often give attractive effects.

Draw a plan to a scale, as suggested for vegetable gardens.

Location of garden.— Do not plan to have the flower garden too prominent. The garden should be staked so that the space to be spaded and fertilized will be defined. Apply a good coating of well-rotted horse manure to the staked patch. With a spading fork or spade turn the manure well under, and break the lumps, but do not rake the ground until just before planting.

Planting.— The time of planting and the method to be followed cannot be given accurately without knowledge of local conditions; but the young gardener will find the table on page 1009 helpful, and also the information relating to individual plants given on pages 1005 to 1008. Obtain as much advice as possible from persons who have been successful in growing flowers in the locality.

Transplanting.—The seedlings which have been grown from seed sown in hotbeds or in boxes in the house are later transplanted as follows: When seedlings are about an inch high, they should be transplanted to flats. Before transplanting, water the seedlings thoroughly so that a good quantity of soil will stay on the roots. Wet the soil in the flats before setting the seedlings in them. Press the soil firmly around the transplanted seedlings. As the plants develop, gradually harden them by placing the flats out-of-doors when weather conditions are favorable. When all danger of frost is past the seedlings can be planted in the garden, the same care being taken as for the previous transplanting.

Watering.— When transplanting, and in case of drought during the summer, it will greatly benefit the garden if a liberal amount of water can be supplied either with hose or watering-pot. After the watering is done, find out, by means of a stick or with your finger, how deep into the soil the moisture has gone. If there is a dry place in the soil between the topmost layer and the lower moist soil, apply more water.

Thinning.— If the seed is sown in the garden, much care must be taken to thin the plants according to the distances given in the table on page 263. Each plant should have room for its best development.

Cultivating.— A fine, light layer of soil should be kept on the surface of the garden. This checks loss of water from the soil by evaporation, and should also result in destroying weeds. Such a surface, called a mulch, can be secured with a hoe, followed by dragging a rake lightly over the land. Good cultivation is necessary for success in gardening.

CULTURAL METHODS FOR THE DIFFERENT FLOWERS

Ageratum.— Ageratum grows well on a wide range of soils, although a sandy loam will give better results than a clay loam.

For early bloom the seed should be sown in hotbeds or in boxes in the house in March, and transplanted later to the garden. For summer and fall bloom the seed may be sown one quarter to one half inch deep in well-prepared beds outdoors, in rows twelve inches apart, thinning the plants later to six inches apart in the row.

Ageratum is an attractive blue flower and is much used in bedding and for borders.

Alyssum.— A well-prepared, rich soil is best suited to this annual. Plant the seed one fourth to one half inch deep in rows twelve inches apart. Later thin the plants to six inches apart in the row.

Alyssum is easily grown indoors and out. It is well suited for beds and for borders of beds in summer, or for pots or boxes in fall and winter.

Cutting back the dying flower stalks after the first bloom will result in further production of blossoms.

Aster.— For its best development this very popular annual requires a soil in excellent condition. A considerable quantity of well-rotted manure should be thoroughly mixed with the soil. Plant the seed outdoors in May about one half inch deep in rows twelve inches apart. Later thin the plants to nine inches or a foot apart, according to size. The plants should bloom during September and October. For early bloom sow the seed in hotbeds in April and transplant to the open ground after all danger from frost is past.

Small quantities of air-slaked lime or wood ashes, stirred into the surface of the soil, will greatly benefit aster plants.

Balsam.— Balsam thrives in rich soil and hot, sunny weather. It needs plenty of water.

The seed may be sown for early bloom about the middle of March, in hotbeds or in flats that are kept in the house.

Later the seedlings should be transplanted according to the general directions.

For outside planting sow the seed in May about half an inch deep in rows twenty-four inches apart. When four to five inches tall, thin to twenty-four inches apart in the row.

Candytuft.— A rich garden soil is best suited for this annual. Sow the seed the last of April or the first of May, about one quarter inch deep in rows twelve inches apart. Thin the plants when about an inch high until they are four to six inches apart in the row, thereby causing them to branch freely and produce larger flowers. Make another planting about the last of June for fall flowers.

For borders the white flowers of the candytuft are desirable. They are used also for beds, for massing, and for rock planting. They bloom freely and are very fragrant.

Cockscomb.— The young plants may be grown from seed sown in the hotbed in April or in the cold-frame early in May, and transplanted to the open ground the last of May. The seedlings should be transplanted into rich soil in order to secure the best results. The seed may be sown in the garden the middle of May about one fourth inch deep, in rows eighteen inches apart, and later thinned until the plants are about twelve inches apart. For the tall plumed cockscomb the rows should be two feet apart and the plants two feet apart in the row.

Larkspur.— The larkspur thrives in any good garden soil, but is much better in color and size when grown in a deep, rich sandy loam, one that has been dug deeply and well enriched with old, rotted manure. The seed of the dwarf variety should be sown in the open ground early in May, one fourth inch deep in rows twelve inches apart, thinning the plants a little later until they are twelve inches apart in the row.

Marigold.— The marigold is easily cultivated. The soil should be carefully prepared but need not be rich. The seed may be sown in the open ground in May, about one half inch deep in rows twelve inches apart, and the plants thinned later to six inches apart in the row. Better results may be obtained by growing the seedlings in the hotbed or in the house, transplanting them to the garden after danger from frost is past.

Mignonette.— This annual is easily and successfully grown in any good garden soil. Plant the seed in the garden about the middle of May one fourth inch deep in rows twelve inches apart. When the seedlings are two or three inches tall, thin to twelve inches apart.

Nasturtium.— Too rich soil for nasturtiums results in great leaf development, and often in rotting of the plants in wet weather. A thin, poor soil is much better for the largest amount of bloom.

The seed may be sown the first of May, in drills about three quarters of an inch deep, with the rows twelve inches apart. When the seedlings are about two inches tall, thin to twelve inches between the plants. Blossoms on dwarf varieties appear about two months after sowing the seed, and, if the blossoms are picked, the plants will continue to bloom throughout the season.

Pansies.— Pansies do best in a cool, rather moist, well-prepared garden soil. Sow the seed early in April, in drills about one fourth to one half inch deep. Have the drills, or rows, twelve inches apart. The plants when about two inches tall should be thinned to six inches apart. For the best results pansies require some shade during the heat of summer. Systematic picking of the blooms, allowing no seeds to form, will lengthen the flowering period.

For early spring bloom the seed is sown in September in a cold-frame or in rich, moist garden soil. Some covering for protection during the winter is necessary. In the spring some of the plants can be transplanted to other beds and all allowed to bloom early.

Phlox.— Few annual plants are more easily grown from seed, bloom more profusely, or offer such a variety of colors as do the phloxes.

The seed should be planted one fourth of an inch deep in well-prepared garden soil. The rows should be eighteen inches apart, and the plants later thinned to twelve inches apart.

Seed may also be planted in the hotbed or in a box in the house, and later the seedlings transplanted according to the general directions. In order to make the plants more bushy and to lengthen the blooming period, remove all flowers when slightly past their most attractive period of bloom.

Salvia. —A fairly rich sandy loam will produce good growth and bloom of this bright-colored, late autumn annual. Seed may be sown outdoors in May, about one half inch deep in rows two feet apart, and as this is a fairly large-growing plant it must be thinned to eighteen inches apart in the row. It may also be raised in the hotbed and transplanted to the garden. The best use for the salvia, or scarlet sage, is for a bed or border plant, especially if intense color is desired.

Snapdragon.— The peculiar form of the flowers of this plant always attracts attention. From seed that is sown outdoors in May, blooms will be obtained through August and September. Plant the seed rather shallow in rows one foot apart, and thin the plants to stand twelve inches apart. For early bloom the snapdragon may be started in the hotbed and transplanted to the garden about the first of June.

The greatest value of the snapdragon is as a border plant and for use as a cut flower.

Stocks.— Stocks have a bushy habit of growth, are very vigorous, and have fragrant flowers in many colors. They have a long blooming season.

The plants are grown successfully in a wide range of soils and with varied cultural methods. Good garden soil, well-prepared, will give satisfactory results. Plant the seed outdoors in May, rather shallow, in rows eighteen inches apart. The plants should be thinned later to stand at least one foot apart. For early blooms the seed may be sown in the hotbed, and with one or two transplantings the plants will be in the best condition for the development of a large number of blossoms.

Stocks are very useful for bedding purposes, for borders, for house or conservatory culture, and for cut flowers.

Sweet William.— This plant requires a good garden soil in the best condition. The seed may be sown in May or June, one fourth to one half inch deep in rows twelve inches apart. When the seedlings are two or three inches tall they should be thinned to six inches apart.

For early bloom seeds can be sown in the hotbed, the seedlings being transplanted later according to the general directions.

Verbena.— For general outdoor use the seed may be sown the first week in March, either in a hotbed or in a flat in the house. Soak the seed in tepid water for one or two hours, sow in the seed box, which has been filled with light, rich soil, cover the seed one fourth of an inch deep, press the soil down firmly, water only sparingly. When the seedlings have grown to about an inch tall transplant them into flats or boxes, allowing two or three inches between the plants.

About the last of May or the first of June transplant the seedlings into the garden, selecting a sunny place for them. The soil should be rich and well compacted, allowing good drainage however. Set the plants in rows eighteen inches apart, the plants being eighteen inches apart in the row. Give clean culture until the verbenas cover the ground, making a carpet of flowers when in full bloom.

Zinnia.— Sow the seed outdoors the last of April in a rich garden soil, in rows twelve inches apart, thinning the seedlings when two or three inches tall to at least twelve inches apart in the rows. These plants should bloom throughout the entire season. The zinnia can be grown in the hotbed and transplanted, giving earlier blooms.

The plants can be used for borders or beds.

PLANTING TABLE FOR FLOWERS

Variety	Amount of seed for 10 feet of row	Depth to plant seed	Distance apart of rows	Distance apart of plants in row	Time for planting		Height of plant (well-grown)	Color of flowers
					Indoors	Open ground		
Ageratum	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	March	May	6 to 9 in.	Blue
Alyssum	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	....	May	3 to 6 in.	White
Aster	1 pkg.	$\frac{1}{2}$ to $\frac{3}{4}$ in.	12 in.	9 to 12 in.	March	May	12 to 36 in.	White
Balsam	1 pkg.	$\frac{1}{2}$ to $\frac{3}{4}$ in.	24 in.	24 in.	April	May	24 to 30 in.	Pink
Candytuft	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	4 to 6 in.	April	May	6 to 10 in.	White
Cockscomb, low	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	18 in.	12 in.	April	May	12 to 18 in.	Red
Cockscomb, tall	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	24 in.	24 in.	April	May	3 ft.	Red
Larkspur, annual	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	12 in.	March	May	12 to 18 in.	Blue
Marigold	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	April	May	6 to 24 in.	Yellow
Mignonette	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	12 in.	March	May	12 to 18 in.	Greenish yellow
Nasturtium	1 pkg.	$\frac{1}{2}$ to $\frac{3}{4}$ in.	12 in.	12 in.	....	May	9 to 12 in.	Red, orange
Pansy	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	March	April	4 in.	Various
Phlox	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	18 in.	12 in.	March	May	12 in.	Red
Salvia	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	24 in.	18 in.	March	May	24 to 36 in.	Scarlet
Snapdragon	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	12 in.	March	May	12 to 36 in.	Yellow
Stock	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	18 in.	12 in.	March	May	12 to 18 in.	Scarlet
Sweet William	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	March	June	18 to 24 in.	Pink
Verbena	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	18 in.	18 in.	March	May	6 to 8 in.	Blue
Zinnia	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	18 in.	April	May	12 to 24 in.	Red

5. How to Plant and Grow Prize-Winning Apple Trees*

The tree is ready for the filling of the hole

RULES FOR THE CONTEST

1. Every boy or girl entering this contest must be under sixteen years of age and a resident of New York State.

2. Each contestant must obtain the consent of parent or guardian and enroll with the district superintendent before beginning any work in the contest.

3. Each contestant must grow the variety of apple and the number of trees of that variety decided on by the leader at the opening of the contest.

4. Each contestant must do all the work of planting, pruning, and caring for the tree or trees, but a contestant may use all the advice and suggestion that it is possible to get from more experienced persons.

5. Each contestant must keep a complete record on blanks furnished by the district superintendent. This record must be signed by two responsible persons who have witnessed both series of measurements and who know them to be correct.

The record constitutes the prize-day exhibit in this contest.

* This contest has never been tried before and is here given merely as a suggestion. It is possible that it can be carried out in those sections of the State in which fruit-growing is the chief industry. It possesses the novel feature that the trees remain and continue to grow from year to year, so that a second series of prize awards may be made at the end of the second, third, fourth, or any subsequent year, as well as at the end of the first year.

APPLE-TREE RECORD

Made by........................ Post-office address...........................
(Contestant's name)

Age............years

This record has been kept by myself in connection with planting and growing ....apple tree(s) for the contest in the Second Supervisory District of Tompkins county.

1. Kind of soil: Clay, sand, black loam, etc..............................
2. Kind of crop last grown on soil..
3. Kind of trees: Variety and age..
4. How were the roots pruned...
5. Planting: Date.......................Tools used..................
   Depth of hole...
6. If there is more than one tree, make a diagram to scale of the planting arrangement on the back of this blank, giving distance apart of trees..............
7. How was the top pruned...
   ....
8. Cultivation: Give a brief description of the care of the tree after planting
   ....
   ....
9. Record:

	Circumference of trunk	Circumference of branches 1-2-3-4-5	New growth of branches 1-2-3-4-5
Tree No. 1			
Preliminary...............	....	....	
Final....................	....	....	
Amount of increase........	....	....	....
Tree No. 2			
Preliminary...............	....	....	
Final....................	....	....	
Amount of increase........	....	....	....

Tree No. 3, etc.

Apparent thrift of Tree No. 1...

No. 2.............................No. 3......................etc.

Condition of the soil..

10. What have you learned from this contest..................................
    ....
    ....

Name...............................
(Contestant sign here)

Date.......................

I do hereby swear that to the best of my knowledge and belief the rules of this contest have been faithfully carried out by.......................and that the above record is correct.

....

....
(Signatures of two other persons)

CULTURAL DIRECTIONS

H. B. Knapp

Soil.— While the apple has a decided preference for certain types of soil, it will succeed moderately well on any soil that is rich, well drained, and retentive of moisture. Perhaps the ideal type would be a light, loose clay loam, but many of our best orchards are situated on either heavier or lighter soils. The land chosen for the setting of trees should have been used for the growing of some cultivated crop the year previous. This crop may have been corn, potatoes, cabbage, beans, or any crop of like nature. Apple trees should never be set in sod or in freshly plowed sod ground, but the land should be worked until it is loose and well pulverized. Trees that are set in sod are very likely to suffer during the hot, dry season of the year because of lack of moisture; and there is nothing else that a young and growing tree needs so much as moisture during the first year while it is becoming established.

Good two-year trees

Time of planting.— It would probably be best, considering all sections of the State, to plant the trees in the spring of the year. Fall planting is desirable provided the land is well drained and the trees are mature when dug from the nursery row. If both these conditions are not present, young trees are very likely to be injured by cold weather. Planting

should be done in the spring just as early as it is possible to work the ground and get it in proper condition. It is highly important that the tree be well established and ready to grow before the dry season is at hand.

Trees.— The trees should be procured from a reliable nurseryman, not from a tree agent. Inasmuch as the trees themselves vary greatly as grown by different nurserymen, even though of the same age, it is important that all the trees used in one district be procured from the same nurseryman. These trees should be two years of age, except the peach, which is always planted at one year of age. All trees should be of the same grade, or XXX trees as they are known to the trade. Trees more than two years of age are not desirable, because, as a rule, they are merely the culls that were not good enough to sell when younger. The trees should all be of one variety, because the habits of growth of different varieties vary greatly. The cost will be about forty cents for a single tree, or possibly less if bought in quantities of ten or more.

Digging the hole.— Having prepared our land and chosen the tree, we are now ready to consider the operation of planting. The best tool for digging holes is either the shovel commonly known as a spoon shovel, or the spade; often it is well to have both. The size of the hole will depend on the size of the root system of the tree; it should be large enough so that the roots are not in any way crowded. When the tree is planted the roots should not be forced out of their natural position. The hole should be deep enough so that the crook at the base of the trunk formed by the operation of budding may be put below ground, leaving only a straight trunk exposed to view. In digging the hole, the top or surface soil should be thrown into one pile and the subsoil into another. Before placing the tree in the hole a few shovelfuls of the surface soil should be thrown into the bottom. This surface soil is usually much richer and looser than the subsoil, so that the roots will start more quickly in it. It is important that the soil that is put into the bottom of the hole be moist. The plan sometimes followed, of putting manure or other farm fertilizer into the bottom of the hole, is not desirable. It acts in the same manner as does a layer of sod on which the tree is planted; that is, it is very likely to cut off the supply of moisture when the tree needs it most. If the land is in fairly good condition there is no need of putting fertilizer into the hole itself.

Pruning the roots.— The roots are injured and broken to some extent by the operation of digging. In general it is sufficient to cut back these wounded stubs to the healthy wood, making a sharp, clean cut. In addition to removing the bruised parts there are often some long, straggling roots that should also be cut back. If there is an excess of fine, matted roots present, some of these should be removed in order that the earth may be packed more firmly about those remaining.

Planting the tree.— After the surface soil is placed in the bottom of the hole and the roots have been pruned, we are ready to set the tree. Only a few shovelfuls of earth should be thrown in at first. This soil should be carefully sifted around the roots and then worked in closely with the fingers. This process should be repeated until the root system is entirely covered up. The dirt may then be thrown in and tramped down firmly, leaving the soil around the tree a little higher than that of the surrounding field because it will settle to some extent. The soil should also be left loose on top so as to prevent drying out. If more

Many of the roots are injured by the digger and must be cut back

than one tree is to be set, the operation is repeated, setting the second tree a distance of thirty to forty feet from the first.

Pruning the tree.— The top of the tree will have to be pruned to some extent; usually there are a number of undesirable branches that should be removed. The two-year-old tree always has the branches of the head formed when it is sent from the nursery, consequently the grower chooses the best of these branches for forming the framework of the tree. Three to five branches are commonly allowed to remain; these are chosen in such a way that a well-balanced type of head is secured. These branches should come out from the main trunk at distances of four to eight inches apart and on different sides of the tree. This is in order to avoid the formation of crotches later in life, and thus to eliminate as far as possible the danger of the tree's breaking down when laden with fruit or when

exposed to strong winds. The branches are then cut, or headed, back to a length of twelve to eighteen inches. The cuts should be made close to a bud with a drawing motion of the knife. The top bud is usually an outside bud, because it is desired that the branch that comes from it shall grow outward rather than inward toward the center of the tree. There is usually present a central branch, or leader as it is called, which will continue the growth of the trunk if allowed to remain. This may well be taken out.

The crook formed by the operation of budding should be put below ground when the trees are set in the field

Preliminary records. — In the presence of two reliable witnesses the following measurements should then be taken: circumference of the trunk and circumference of the main branches. The circumference of the trunk should be taken at the base of the tree about two or three inches above the place where it was budded, or far enough above the crook to be sure that the measurement obtained is not too close to the enlargement formed by the operation of budding. These measurements may be taken with a piece of string, the length of which may be determined by measuring on a square or rule. The circumference of the main branches should be taken close to the point where they spring from the tree and may be found in the same manner.

Cultivation.— The tree must be well cared for during the growing season. The ground should be cultivated at least once a week during the summer until the middle of August. This is in order to prevent the soil from becoming dry, and to preserve, as far as possible, the moisture content of the soil in which the roots are situated. In August a cover-crop of rye or buckwheat may well be sown about the tree. This uses up the excess moisture and protects the land about the tree roots during the winter. Often the tree continues growth so late in the season that the buds are immature when cold weather comes if a cover-crop is not used. The cover-crop should not be sown too close to the trunk of the

tree, else it will afford a hiding-place for mice during the winter. Two or three feet should be left bare on all sides of the trunk. It is not always possible to cultivate the entire surface of the ground during the growing season. In case this cannot be done, the soil should be kept loose for a radius of two or three feet about the trunk by means of a hoe or spade.

Final records.— As soon as the growing season is over we are ready to compute the amount of growth that the tree has made during the year. This may be done at any time when it is convenient after the first of September, but the wood and the buds will not be mature at that time hence they will not possess the proper color. The later the examination is made, then, the more accurate it will be. It might even be well to wait until the succeeding spring before attempting to decide the contest, in order that the way in which the tree survives the winter may also be taken into consideration. In the presence of the same two witnesses, the same measurements that were taken in the spring should be taken in the fall, and, in addition, the amount of growth that the branches forming the head have made that year should be determined. The apparent thrift of the tree should also be noted, as well as the condition of the soil in which the tree is growing. The tree which has made the greatest development in circumference of the trunk and of the main branches, and in annual growth as well, and which appears to be the most thrifty and well cared for, should then be awarded first place.

Subsequent treatment.— The tree should not be neglected after the first-year contest is over, for it will bear fruit in the years to come. It should be protected during the winter by some material that will prevent mice and rabbits from gnawing and injuring the trunk. This material may be wire netting of fine mesh, about one fourth inch, and eighteen inches wide. It should be put around the tree loosely in order that it may be left for several seasons. Another satisfactory material is tarred paper, which may be tied loosely about the trunk. This should not be put on until late in the fall, however, and should be removed very early in the spring before the warm weather comes on, inasmuch as the bark may be injured if the paper is allowed to remain late in the spring.

The pruning of the tree in the second spring will consist in removing the cross-branches — those that grow toward the center of the trees or those that depart in any way from the ideal toward which the grower is working. In general, two side branches are allowed to remain on the main branches of the head. The selection of these branches will depend on the space that it is desired to fill. These branches should be headed back in the same manner as were those of the preceding year. The cultural operations and the manner of conducting the competition will not differ materially from those of the first year.

GROUP II. CONTESTS FOR BOYS SIXTEEN TO TWENTY-ONE YEARS OF AGE *

A Letter to the Boys

Dear Friends:

You are hearing much these days about modern agriculture and scientific farming. You read in the state and federal bulletins of the investigations being conducted by the experiment stations of our country. You are told that there are excellent opportunities to-day for the boy who knows how to conduct the business of farming.

In the following pages an attempt has been made to explain, in simple, straightforward manner, the best practice in growing certain crops as that practice has been developed by investigators in the laboratory and on the farm. An opportunity is given to you to raise a single crop on limited area in accordance with the best known methods. While this is not by any means all that there is to successful farming, it is one of the essentials. Moreover, if you are the boy who expects to know, you will profit by the successes and failures of the other boys; if you do not have the prize crop, you will find out who does and why that crop is better than yours.

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* In all contests in this group, it is essential that there be a uniform standard of labor and equipment costs for the entire district. The State College has not felt it wise to establish such standards for the entire State because they vary from place to place and from year to year. It will be possible, however, to arbitrarily establish average standards which shall hold for the particular contest.

In regard to the selling price of the product there are two alternatives: 1 The prevailing market price may be taken as the basis of all computations. 2. The prevailing market price may be taken as the minimum value, but any amount over and above the market price which the boy may secure through his own initiative shall be recognized and credited to him accordingly. This plan adds one feature to the contest, namely, skill in the marketing of the crop, which always counts in good farm practice.

You may want to try a rotation of crops on the piece of land that has been turned over to you by your father. If you raise corn this year you may wish to raise oats next year, following the oats with clover.

We are learning that the successful farmer is the man who knows how to take advantage of other men's knowledge, but only so far as it fits his conditions. It may be that the condition of your potato land is such that flat cultivation will bring you the best yield and the best potatoes, but this does not signify that the same is true of your neighbor who has a different soil condition. It is to be hoped that you will get some practice in adapting information to your own farm.

You have learned in your geography study in school about the products of other countries and of the States in your own country. In what parts of the world is your special crop grown to the greatest extent, and what are some of the reasons for this distribution of production? How does it compare in acreage with other crops? in cash value? Is it marketed, fed, or manufactured in these various regions? These are some of the questions the answers to which help determine whether or not, in the long run, the crop is likely to be a paying one.

You have learned to read and to use a dictionary. Can you read and understand the various terms used in connection with your crop? How accurately can you express in your report the account of your work and its results?

Do you know what weeds will probably grow with your crop, and how best to head them off? Do you know the general means of determining the character of soil in a field? Do you know what insects and diseases may possibly attack your crop and, if so, how to fight them? All these questions will afford you plenty of opportunity for study before you plant, and during your spare time after planting. These are some of the problems that the successful farmer must solve.

In the early history of our country the farmer was almost a social hermit. He had little contact with the centers of trade. This condition was due both to the undeveloped means of travel and communication and to the fact that few persons were entirely dependent on him for all the necessities of life. The invention of the telephone and telegraph, the development of railroads, and good roads have made travel and communication easy. The collecting of great numbers of persons in cities, where they cannot raise even a blade of grass, has caused a multitude to become entirely dependent on the farmer for the food necessities of life. The gap between these dependents and the source of supply is wider than it should be. The farmer of to-morrow, either himself or through his agents, will come directly in contact with these dependents. This means that the successful farmer must work hand in hand with his

fellowman rather than by himself alone. These contests will offer you boys an opportunity to begin this cooperative work early in life.

The State College of Agriculture at Ithaca is prepared to make ready for your use all the knowledge at its command; but you must remember that the extent to which this knowledge becomes yours depends on you, for the law of life cannot be changed. That law as applied to you in this case would read: "The State stands ready to help him who helps himself." If you enter these contests with a determination to do your best, and do it, you will be amply repaid whether you take a first prize or none. The school cannot educate you; the church cannot educate you; the State cannot educate you; your parents cannot educate you. They may all offer you means of education, but you must educate yourself. No one can do the work for you, although he may point the way. Nothing can ever take the place of your own effort. Make a try and do your best.

Now, boys, just a word about education. You may have heard that a man gets an education "so he will not have to work so hard." That is a mistaken idea. The real joys of life lie not in idleness but in work well done. Your own idea of a good time is not sitting down with folded hands, but "something doing." Just now your ideals are of strength, skill, and bravery. The nearer you are to what you want to be, the better you are satisfied. Soon your desires will change and a new game will demand your attention. Now is the time to get ready, so that when you want to be the best farmer in your neighborhood you will have something on which to start.

Be purposeful. Be strong.
Defend the right. Know not the wrong.
Be earnest. Be busy.
Stick to a task till it's done.
Play hard. Be fair.
Even though you've lost, you've won.

Yours truly,

Layton S. Hawkins.

Specialist in Agricultural Education.

State of New York,
Education Department.

1. CORN; ACRE CONTEST

RULES OF THE CONTEST

1. Every contestant shall be between sixteen and twenty-one years of age and shall be a resident of New York State.

2. Each contestant must obtain the approval of his parent or guardian and enroll with the district superintendent before beginning any work connected with the contest.

3. Each contestant must do all the work of preparing, planting, cultivating, and harvesting one acre of corn, but he may make use of all the advice and information that he can obtain.

4. Each contestant must keep a complete and accurate account of the cost of labor, seed, fertilizer, rent, or other charges connected with the crop, and present the complete account, showing the profit or loss resulting, with his exhibit on prize day.

5. Before harvesting is begun the area on which the crop is grown must be measured by the district superintendent or his representative, and by the contestant, and the former must certify to the exact size of the area.

6. The yield of ear corn and the yield of fodder produced must be weighed in the presence of two disinterested, responsible persons, who must certify that the weights reported are correct.

7. Each contestant must select one bushel (seventy pounds) of ear corn from the product of his one acre, and exhibit these on prize day together with his records.

8. A brief story, telling how the crop was grown, giving details of the work connected with it, and describing any particular features that were noticed by the contestant, must be submitted on prize day with the crop records and the exhibit of ears.

RECORD OF THE CONTEST

RECORD BLANK FOR ONE-ACRE CORN CONTEST

SECOND DISTRICT, TOMPKINS COUNTY

Name........................ Post-office address....................
Town......................Age of contestant....................years

1. Kind of seed planted..
2. Seed procured from..
3. Amount of seed planted..
4. Kind of soil in which planted: Clay, sand, black loam, etc................
5. Kind of crop raised on same ground last year............................
6. How ground was prepared for seed..
   ....
   ....
7. Fertilizer used, if any: Kind and amount................................
   ....
8. Planting: Date...............Depth.......................In drills
   or hills....................Distance apart of hills....................
   or estimated average distance apart of stalks in drill.....................
   Number of rows..................Length of rows...................
9. Cultivation: Dates, first...................second....................
   third....................fourth...............etc...................
   How cultivated...
   ....
   ....
   What tools or machinery were used..
   ....
10. Date of cutting corn......................Date of husking corn.........
    ....Number of bushels of husked corn................
    Weight of sample before drying ....after
    drying...................Loss in weight.............Percentage.....
11. Expense in time, labor, and money:
    Value of contestant's time at........cents per hour........... $.......
    Value of work of horses at........cents per hour for each horse.. $.......
    Other expenses itemized (seed, fertilizer, rent, etc.)..............
    .... $.......
    Total cost of crop.............................. $.......
    Value of grain at market price.............................. $.......
    Estimate of value of stover (all of corn except grain)............ $.......
    Total value of crop.............................. $.......
    Amount of profit or loss.............................. $.......

Date........................... Signed...................................
Contestant

I do hereby swear that I have measured the land on which the contestant,........
...., raised the corn reported in this record, and find it to be one acre.

....
District Superintendent or Representative

I do hereby swear that the yield of ear corn and the yield of fodder produced on the above acre by.......................have been weighed in my presence and that the weights reported are correct. I further swear that to the best of my knowledge and belief all the rules of the contest have been faithfully and honorably observed.

First name...

Second name...

CULTURAL DIRECTIONS

E. R. Minns

Choosing the soil.— In order to grow the largest yield of corn at the least expense, you should choose the warmest and most fertile soil on the farm. It should be fairly well drained and well stocked with humus. Although climate has much to do with the success of a corn crop in this State, you will be most likely to get a good yield if you choose the soil carefully.

Preparation.— In laying off a plot of one acre, you should first decide on the distance between the rows that you will plant. Then you can decide on how many rows wide the plot must be, and make the length for one acre accordingly. If the land has not already been well manured before you decide to use it for corn, it should have twenty or more loads of barnyard manure applied to it. Well-rotted or partially decayed manure may produce the largest yield per acre, but it will increase the cost of manuring. Two loads of fresh manure are equivalent to about one load of well-rotted manure. The plowing should be done as early as the ground is dry enough for good plowing. This will give time for the furrows to become settled and for capillarity to become again established in the soil. If the ground is a piece of sod or if it has a winter cover-crop on it, the early plowing will prevent rapid evaporation of moisture from the soil and at the same time start decay in the vegetable matter plowed under. Plowing, harrowing, and cultivating in the spring all tend to make the soil warmer, and that is important in starting a crop of corn. If the ground can be plowed a month before time to plant the corn, so much the better. If the ground is moist, use the roller sparingly. Corn roots need a mellow seed bed. The roller may press the soil together too closely for good corn-growing. If the furrows become somewhat dry before you can fit the seed bed with harrows, the roller will help reestablish the capillarity and crush any dry lumps of soil. The cornfield, when ready for the planter, should be fairly smooth and the surface lightly stirred.

Fertilizers.— Ordinarily, good crops of corn are grown without the aid of commercial fertilizers. To grow a large crop of corn may require the use of some good fertilizer rich in nitrogen, phosphorus, and possibly potash. On peaty soils, potash especially is beneficial to corn. Just before seed-sowing, three to five hundred pounds of the fertilizer should be mixed with the soil where the corn plants will get it early in their growth. The amount of fertilizer used should be regulated by the probable benefit and by the cost. Excessive use of fertilizers may produce a big crop, but at an expensive cost that will offset the advantage of increased yield.

Seed corn.— In New York State it is probably better to use seed corn that is grown somewhere near by and acclimated to the region. Do not try something that is new to the locality and not certain of maturity. Corn varieties are sensitive to changes in location, and a well-bred, acclimated variety is best for such a contest as this. The seeds should be of good vitality in order to secure a full stand of plants. This is important in growing a crop for high yield on one acre.

Planting.— For one acre of corn it may be best to plant the corn carefully in check rows with a hand planter; or you may use a horse planter with which you have had experience and which you can regulate properly. Remember that time saved in all the operations of corn-growing, including planting, will lessen the cost of the crop. Corn planted in hills and check-rowed may be less expensive to cultivate, although there is no certainty that it will yield more than corn planted in drill rows and properly cultivated. Sow more seed than will be required to make a full stand of plants. You will need to thin out the weaker ones, and some may be damaged by insect enemies, birds, or animals. The best protective coating to use on seed corn consists of coal tar well distributed through the seed corn by stirring with a paddle. The tar is heated in order to make it thin, and only a very little is needed to cover four quarts of seed.

Cultivating.— The cultivation of a good corn crop must begin before the corn is planted, that is, in the thorough preparation of the seed bed. Before the corn is up, weed seeds will begin sprouting near the surface, especially where footprints or wheel-tracks have pressed the soil down and drawn moisture nearer the surface. On good corn land a weeder will help save the moisture, and at the same time destroy sprouting weeds if used on the corn rows. Weeding is most effectively done when the sunshine is bright and the weather somewhat dry. The weeder may be used in some cases every two or three days for two weeks after planting When the corn rows can be seen, thorough and deep cultivation with horse cultivators is necessary. Before the corn roots reach out into it, stir the soil on each side of the row deeper than you planted the corn. This will warm the soil. If the rows can be cultivated every week until the corn tassels, gradually lessening the depth each time, it will hasten the growth of the corn and help save the moisture which is so much needed in the later stages The late cultivations, particularly, should be shallow, and are meant to save the water rather than to kill weeds. Bushels of corn are sometimes made by careful cultivation during midsummer. A wet season may make it unnecessary and impossible to give these late cultivations in the cornfield.

Harvesting.— Your yield of corn is to be reckoned not merely on the basis of the ears produced, but on the fodder yield as well. It is important,

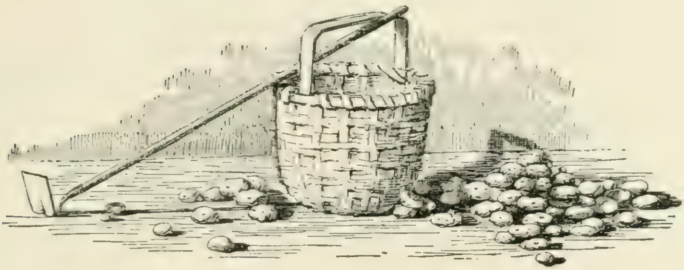
then, that the fodder be saved in the harvesting. Wait until the corn husks begin to turn yellow and some of the lower leaves are drying up, then cut the crop and shock it in rather small shocks, so that it will cure rapidly. Three or four weeks of good autumn weather will cure it sufficiently for husking. Husk the ears from the fodder when the latter is tough. A cloudy day or a damp morning is much better than a bright midday with a dry wind blowing. You save the fodder by handling it when it is tough. Tie the fodder in bundles, ready for weighing, and do the work of weighing both fodder and grain where it is most convenient. Choose a sample consisting of several ears of corn, weigh the sample, and dry it indoors beside the stove. Determine what percentage of moisture has evaporated from this sample in becoming perfectly dry, and include this in your report.

Rural School Corn Show

The exhibit.—When the corn is weighed choose enough ears to make a bushel of ear corn, and store it where it will not mold and where mice cannot damage it. Be sure to pick out the best ears in the crop. Use the score card intended for the ten-ear contest as a guide in choosing these specimens. (Page 985.) The result of the contest will be decided partly from the bushel of corn that you exhibit and partly from the record of results that you present with it, according to the following score:

Yield	30 points
Profit shown	30 points
Bushel of ears	20 points
Story of the crop	20 points

2. POTATOES; HALF-ACRE CONTEST



RULES OF THE CONTEST

1. Every contestant shall be between sixteen and twenty-one years of age and shall be a resident of New York State.

2. Each contestant must obtain the approval of his parent or guardian and enroll with the district superintendent before beginning any work connected with the contest.

3. Each contestant must do all the work of preparing, planting, cultivating, and harvesting his half-acre of potatoes, but he may make use of all the advice and information that he can obtain.

4. Each contestant must keep a complete and accurate record of the cost of labor, seed, fertilizer, rent, or other charges connected with the crop, and present the complete account, showing the profit or loss resulting, with his exhibit on prize day.

5. Before harvesting is begun the area on which the crop is grown must be measured by the district superintendent or his representative, and by the contestant, and the former must certify to the exact size of the area.

6. The yield of all potato tubers grown on the half-acre must be weighed in the presence of two disinterested, responsible persons, who must certify that the weights reported are correct.

7. Each contestant must select one bushel (sixty pounds) of potatoes from the product of his half-acre, and exhibit this on prize day together with his records.

8. A brief story, telling how the crop was grown, giving details of the work connected with it, and describing any particular features that were noticed by the contestant, must be submitted on prize day with the crop records and the exhibit of potatoes.

RECORD OF THE CONTEST

RECORD BLANK FOR ONE-HALF-ACRE POTATO CONTEST

SECOND DISTRICT, TOMPKINS COUNTY

Name........................Post-office address......................

Town...................Age of contestant......................years

1. Kind of seed planted..
2. Seed procured from..
3. Amount of seed planted..
4. Was seed treated for scab fungus......................................
5. Kind of soil in which planted: Clay, sand, black loam, etc................
6. Kind of crop raised on same ground last year..........................
7. How ground was prepared for seed......................................
   ....
   ....
8. Fertilizer used, if any: Kind and amount..............................
   ....
9. Planting: Date...................Depth.....................In drills
   or hills....................Distance apart of hills....................
   or estimated average distance of plants in drill row.....................
   Number of rows...................Length of rows..................
10. Cultivation: Dates, first...................second..................
    third....................fourth................etc..................
    How cultivated...
    ....
    ....
    What tools or machinery were used.....................................
    ....
11. Were the potatoes sprayed....................When....................
    With what...
12. Date of digging potatoes................Yield in pounds.................
13. Expense in time, labor, and money:
    Value of contestant's time at........cents per hour........... $.......
    Value of work of horses at.......cents per hour for each horse.. $.......
    Other expenses itemized (seed, fertilizer, rent, etc.)............
    .... $.......
    Total cost of crop........................... $.......
    Value of potatoes at market price................. $.......
    Amount of profit or loss....................... $.......

Date.........................Signed.......................................
Contestant

I do hereby swear that I have measured the land on which the contestant,.......... ...., raised the potatoes reported in this record and find it to be one half acre.

....
District Superintendent or Representative

I do hereby swear that the yield of potatoes produced on the above one half acre by.......................has been weighed in my presence and that the weight reported is correct. I further swear that to the best of my knowledge and belief all the rules of the contest have been faithfully and honorably observed.

First name..................................

Second name..................................

CULTURAL DIRECTIONS

E. R. Minns

Choosing the soil.— Be sure to choose a well-drained, deep, porous, rich soil for this contest. Potatoes thrive best in cool, moist, fertile soils. Choose soil that has previously been well cultivated, is free from weeds, and is well stocked with humus.

Preparation.— For potatoes good plowing is essential. If possible, plow the land ten inches deep. If not well manured the year before, be sure to plow under fifteen or twenty loads of well-rotted manure on your half-acre. Fall plowing, followed by a winter cover-crop and this plowed under fairly early in spring, makes the seed bed mellow and in good shape for potato-growing.

Fertilizers.— Potatoes respond to the use of commercial fertilizers more profitably than do many other crops. On sandy soils five hundred to one thousand pounds per acre of complete fertilizer, rich in potash, is used with good results. Do not use lime or wood ashes on your potato plot, because the disease known as scab is made worse thereby.

Seed.— Choose the best variety of potato that you can find in your locality. It should be tested and tried and found worthy. The tubers used for seed should have been carefully selected, if possible from the field where they grew the year before. They should have been well stored and should not have been allowed to sprout. Freedom from scab is desirable in seed potatoes, but scab germs on seed potatoes can be killed by treating with formalin solution before cutting the seed.

Planting.— For a half-acre, machine-planting may well be adopted, provided the machine is one that will open a good furrow with loose soil on each side in which to drop the seed pieces, and will drop the seed accurately. Hand-planting had better be used if hills are wanted or if the planters available are not satisfactory. In deep soil plant potatoes deeply, but do not cover to the full depth until the sprouts are coming through the first covering. The seed bed should have plenty of loose, mellow soil in which to place the seed pieces.

Cultivating.— Give potatoes thorough cultivation while they are sprouting and coming up. Use both weeder and cultivator for keeping the soil loose and free from weeds. As the plants increase in size cultivate less deeply or else hill earth up to them, and do not injure the roots. Continue cultivation until the potato vines will not allow of it.

Spraying.— Experiments have demonstrated that systematic spraying of potatoes for blight is profitable. The standard remedy for potato blight is bordeaux mixture. It should be applied thoroughly with a spraying machine from the time the plants are six inches high until they

come to maturity. A coat of spray every two weeks throughout the season will keep the new growth of the vines protected to a very large extent. For killing potato beetles, add one pound of paris green or three pounds of arsenate of lead to fifty gallons of bordeaux mixture. Spraying three to five times is followed in practice with profitable results.

Digging.— If the soil chosen is not stony and the potatoes have been given clean cultivation, a potato digger can be used to good advantage in harvesting the crop. The digger should not cut nor damage the potatoes. Hand-digging is more expensive than machine-digging for a half-acre crop. The digging should be done when the soil is dry enough to rattle from the potatoes in handling. Gather all the tubers that are sound, and weigh the entire crop.

Choosing the exhibit.— The bushel chosen for the exhibit on prize day should contain the very best of the crop. The tubers should be chosen in accordance with the score card given for the quarter-bushel potato contest. (Page 990.) More than a bushel should be chosen at digging time and stored in a cool, dark place until the time for the exhibit. The result of the contest will be decided on the following score:

Yield	30 points
Profit shown	30 points
Bushel of potatoes	20 points
Story of the crop	20 points

3. OATS; ACRE CONTEST*

RULES OF THE CONTEST

1. Every contestant shall be between sixteen and twenty-one years of age and shall be a resident of New York State.

Side panicle

2. Each contestant must obtain the approval of his parent or guardian and enroll with the district superintendent before beginning any work connected with the contest.

3. Each contestant must do all the work of preparing, planting, cultivating, and harvesting one acre of oats, except that he may have assistance in hauling, threshing, and recleaning the oats.

4. Each contestant must keep a complete and accurate account of the cost of labor, seed, fertilizer, rent, or other charges connected with the crop, and present the complete account, showing the profit or loss resulting, with his exhibit on prize day.

5. Before harvesting is begun the area on which the crop is grown must be measured by the district superintendent or his representative, and by the contestant, and the former must certify to the exact size of the area.

True panicle

6. The yield of recleaned oats must be weighed by the contestant in the presence of two disinterested, responsible persons, who must certify that the weights reported are correct.

7. Each contestant must choose one bushel (thirty-two pounds) of his recleaned and weighed oats, and exhibit these on prize day together with his records. The oats thus exhibited must not be further sorted nor "clipped" in any manner after the yield has been weighed.

8. A brief story, telling how the crop was grown, giving details of the work connected with it, and describing any particular features that were noticed by the contestant, must be submitted on prize day with the crop records and the exhibit of oats.

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* In starting the oats contest, consideration should be given as to whether a clover contest is to follow it, carrying out the rotation scheme mentioned on page 226. In case it is, both these contests should be started at once. See pages 1032 and 1035.

RECORD OF THE CONTEST

RECORD BLANK FOR ONE-ACRE OATS CONTEST

SECOND DISTRICT, TOMPKINS COUNTY

Name............................Post-office address..................
Town..................................Age of contestant........years
1. Kind of seed planted...
2. Seed procured from...
3. Amount of seed planted...
4. Was clover or other hay seed sown with the oats.........................
5. Kind of soil in which planted: Clay, sand, black loam, etc.................
6. Kind of crop raised on same ground last year..............................
7. How ground was prepared for seed...
....
8. Fertilizer used, if any: Kind and amount....................................
....
9. Lime used, if any: Kind and amount..
10. Date of sowing......................Drilled or broadcast................
11. Date of cutting..................What machine used.................
12. Date of hauling from field..................................How disposed of (threshed immediately, stacked, barn).............................
......................Weight of oats and straw.....................
13. Date of threshing..............................Weight of threshed and recleaned oats...
14. Expense in time, labor, and money:
Value of contestant's time at........cents per hour........... $.......
Value of help, if any, in threshing and recleaning the oats (at.... cents per hour for a man, ...cents per hour for a boy)...... $.......
Value of work of horses at........cents per hour for each horse.. $.......
Other expenses itemized (seed, fertilizer, rent, etc.)...........
.... $.......
Total cost of crop.............................. $.......
Value of grain at market price................................ $.......
Estimate of value of straw..................................... $.......
Total value of crop............................ $.......
Amount of profit or loss........................ $.......
Date............................Signed.............................
Contestant

I do hereby swear that I have measured the land on which the contestant,.......... ...., raised the oats reported in this record and find it to be one acre.

....
District Superintendent or Representative

I do hereby swear that the yield of oats and straw and the yield of oats produced on the above acre by..........................have been weighed in my presence and that the weights reported are correct. I further swear that to the best of my knowledge and belief all the rules of the contest have been faithfully and honorably observed.

First name........................

Second name........................

CULTURAL DIRECTIONS

E. R. Minns

Choosing the soil.— Oats will ordinarily make the best yield on a moist, fairly fertile soil. This crop requires a larger amount of water to bring it to maturity than do many other farm crops. If the soil is too rich in nitrogen, oats tend to lodge and that reduces the yield. A clay or clay-loam soil is most likely to contain the necessary moisture during mid-summer, and a region that is naturally cool during most of the growing season is better adapted to oat-raising than a warm one. The soil chosen should be well drained, in order that planting may be done early. Late-sown oats may fail to yield well if the summer turns warm and dry when the oats are making their most rapid growth.

Preparation.— In general practice, oats follow some intertilled crop such as corn or potatoes. They may be sown on other stubble or sod land, provided plowing is done the previous autumn and care is used in making a good seed bed. The ideal preparation is corn stubble that has been heavily manured the year before. Fall plowing on the type of soils best adapted to oats has the advantage of exposing the furrows to the crumbling action of frosts, giving the winter rains or snows a chance to soak into the ground, and making it possible to stir the ground and sow the oats at an earlier date in the spring than if the plowing is deferred until the opening of spring. However, good crops of oats can be raised on spring-plowed land, if enough care is used in fitting the seed bed. The seed bed for oats should be fairly compact, level, and fine to a depth of two inches.

Fertilizers.— On land that normally causes oats to lodge, no nitrogen should be added in the way of fertilizers. Potash and phosphoric acid in moderate quantities may prove beneficial. The use of lime is claimed to be beneficial to the oat crop, and it is needed on many soils in order to insure a good crop of clover following the oats. A moderate application of one thousand pounds per acre of any good agricultural lime may be used if the soil is not well stocked with lime.

Seed.— Because oats are naturally adapted to a cool climate, it is often advantageous to use seed from a region farther north, or at least from one that produces large yields of oats. If good seed can be obtained near by from varieties that have proved their worth as yielders, such varieties can be used. Some varieties of oats tend to decrease in yield the longer they are grown in a locality. The introduction of new varieties from better oat-growing regions is sound policy. Some kinds of oats are quite susceptible to the attacks of loose oat smut. If the seed used has had any of this disease present in the past, it should be treated with a solution of formalin and water in order to kill the smut spores before sowing the seed.

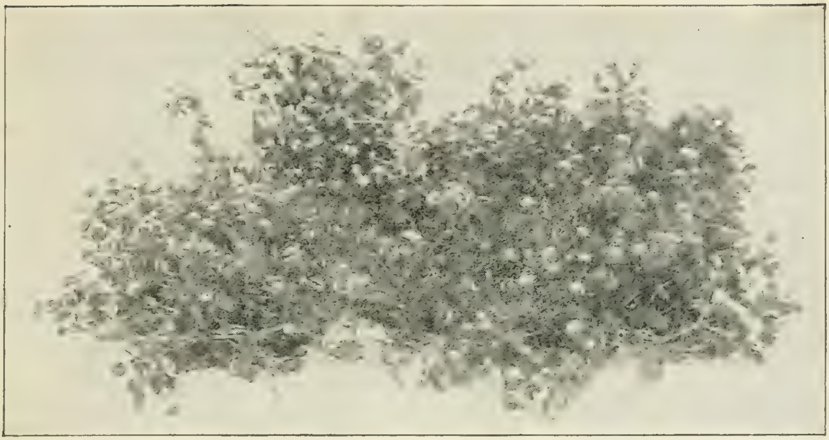
Harvesting.— If a good stand of oats is obtained and weeds and grass are not abundant, the crop is best harvested with a twine binder. Oat sheaves are more difficult to cure than are wheat sheaves. They may be set up in longer shocks, two sheaves wide without any caps, if the weather is fine. If rain threatens, cap-sheaves may be added if the oats are not yet cured. If weeds are numerous enough in the oat field to make curing difficult, it will be better to cut the crop with a side-delivery reaper, and turn the gavels of oats with a fork as they lie unbound on the ground, so as to facilitate curing If wet through by rain they can be dried out in a few days. In order to insure saving the grain, it is best to cut the crop before all the stalks are ripe or while some are yet greenish in appearance. Cutting too green will make a lighter yield of grain.

Weighing and cleaning.— If it is possible to weigh the entire unthreshed oats as they are hauled from the field, the straw and grain should be weighed together, then the yield of straw may be found by subtracting the weight of the recleaned grain. If the weather is dry at harvesting time it is well to thresh oats from the field. If this is not convenient they may be stored under cover until the sweating process is over and then threshed out before mice or rats have done any damage. Oats as delivered from the thresher are seldom clean enough for exhibition. After the oats are threshed they should be recleaned with a fanning mill before weighing the yield. For the exhibit thirty-two pounds of recleaned oats, without any further treatment, should be chosen and stored in a dry place. If the oats are not perfectly dry when threshed they should be spread out in a thin layer for a few days until dry. The results of the contest will be determined on the basis of the following score:

Yield	30 points
Profit shown	30 points
Bushel of oats	20 points
Story of the crop	20 points

If a clover contest is to follow the oat contest, the seed should be sown from the seeding attachment of the grain drill, or by broadcasting just after the oats are sown. For one acre sow three quarts of medium red clover and two quarts of alsike clover, mixed.

4. Clover; Acre Contest



Alsike clover

RULES OF THE CONTEST

1. Every contestant shall be between sixteen and twenty-one years of age and shall be a resident of New York State.

2. Each contestant must obtain the approval of his parent or guardian and enroll with the district superintendent before beginning any work connected with the contest.

3. Each contestant must do all the work of sowing the clover seed, caring for the meadow, and harvesting the crop of hay, except that he may have assistance in hauling and storing the hay.

4. Each contestant must keep a complete and accurate account of the cost of labor, seed, fertilizer, rent, or other charges connected with the crop, and present the complete account, showing the profit or loss resulting, with his exhibit on prize day.

5. Before harvesting is begun the area on which the crop is grown must be measured by the district superintendent or his representative, and by the contestant, and the former must certify to the exact size of the area.

6. The yield of cured clover hay must be weighed by the contestant in the presence of two disinterested, responsible persons, who must certify that the weights reported are correct.

7. Each contestant must choose ten pounds of well-cured hay from his crop, store it in a burlap sack, and exhibit it on prize day with his records.

8. A brief story, telling how the crop was grown, giving details of the work connected with it, and describing any particular features that were noticed by the contestant, must be submitted on prize day with the crop records and the exhibit of clover.

RECORD OF THE CONTEST

RECORD BLANK FOR ONE-ACRE CLOVER CONTEST

SECOND DISTRICT, TOMPKINS COUNTY

Name.........................Post-office address.................
Town.......................Age of contestant...............years

1. Kind of seed planted..
2. Seed procured from..
3. Amount of seed planted..
4. Kind of soil in which planted: Clay, sand, black loam, etc..................
5. Was the clover sown with oats the year before...........................
6. How was the ground prepared for seed.................................
   ....
7. Fertilizer used, if any: Kind and amount...............................
   ....
8. Lime used, if any: Kind and amount...................................
   ....
9. Date of sowing..............................With seeder or broadcast..
10. Was the clover top-dressed with manure after the oats were harvested........
11. Date of cutting...
12. How cured...
    Number of days in field..
    Date of hauling from field..................................Weight of hay..
13. Expense in time, labor, and money:
    Value of contestant's time at........cents per hour.......... $.......
    Value of help, if any, in hauling and storing the hay at ...... cents per hour for a man,........cents per hour for a boy.... $.......
    Value of work of horses at........cents per hour for each horse.. $.......
    Other expenses itemized (seed, fertilizer, rent, etc.).............
    .... $.......
    Total cost of crop........................... $........
    Value of hay at market price..................... $........
    Amount of profit or loss......................... $........

Date...............................Signed.............................
Contestant

I do hereby swear that I have measured the land on which the contestant,.......... ...., raised the clover reported in this record and find it to be one acre.

....
District Superintendent or Representative

I do hereby swear that the yield of clover produced on the above acre by.......... ....has been weighed in my presence and that the weight reported is correct. I further swear that to the best of my knowledge and belief all the rules of the contest have been faithfully and honorably observed.

First name.......................

Second name.......................

CULTURAL DIRECTIONS

E. R. Minns

Making a start.— Clovers frequently follow oats in a good rotation of crops. The contestant who grows oats for a prize one year should prepare to grow clover for a prize the succeeding year. In seeding the clover crop, sow three quarts of medium red-clover seed and two quarts of alsike clover seed on the acre of oats, either when the oats are sown or immediately after. The clover seed can be distributed from a seeding attachment on the grain drill when the oats are sown, or broadcasted afterward. A mixture of two kinds of clover seed is most suitable for many parts of the State. It makes the chances of obtaining a crop of clover hay more certain. In regions where the soil is deficient in lime, the suggestions in regard to lime given for the oats contest should be heeded. (Page 1031.)

When the oats are harvested, care should be taken not to injure the new clover seeding. It will be smothered by leaving oat shocks on the ground too long, or it may be damaged by trampling if the ground is rather wet. It is more likely that the ground will be very dry and that the removal of the oat crop when ripe will leave the young clover plants exposed to the sunshine, and this may result in harm. For the benefit of the clover plants a light top-dressing of barnyard manure, applied with a manure spreader after the oat harvest at the rate of eight loads per acre, will be found very beneficial, especially if the weather is rather dry. The top-dressing of manure helps protect the ground from drought, and if rains fall the growth of the clover will be greatly stimulated by the presence of the soluble plant-food leached out of the manure. With such a protection the clover should go into winter in very good condition. There will be nothing more to do until harvest time the next year.

Harvesting.— The best time to cut clover for hay is when it has blossomed freely and about one third of the blossoms have turned brown. Opinions differ as to the best method of curing clover hay. The following is a safe method, and, if rightly followed, will produce a good quality of hay: Cut the clover when the dew is off. Let it wilt and then stir it with a tedder or with forks before any number of the leaves have become dry enough to break off. Rake the hay into windrows while it is yet tough, and pile into narrow and rather high haycocks. The hay will sweat and be tough inside the cocks for several days; but gradually the moisture will evaporate from the stems through the wilted leaves, and then, if the haycock is opened out for a few hours in small bunches, the hay will be dry enough to store and yet will handle well in the compact bunches. Should a heavy rain occur after the hay is cocked, more time will be required to dry it out before storing.

Some growers prefer to cut down clover hay in the morning, rake it up when it is thoroughly wilted, and store it before night in a tight mow, without trampling. Of course the stored hay becomes very warm and may even threaten to take fire; but in most cases it passes the sweating stage safely in the barn, and, although somewhat blackened by the heat and moisture, it is palatable feed for live-stock. The former process will make better hay for exhibition, and the weight of the yield from one acre will be more nearly correct, than that obtained by the latter method. The amount of curing in the field before storing the clover hay will be taken into account in deciding the results of the contest.

Choosing the exhibit.— For the exhibition of samples on prize day, ten pounds of good dry hay, handled when tough enough to hold the leaves, should be put into a burlap bag and kept until the exhibition occurs. The results of the contest will be determined on the basis of the following score:

Yield of hay	30 points
Profit shown	30 points
Sample of hay	20 points
Story of the crop	20 points

5. VEGETABLE GARDEN; 50 BY 100 FEET

RULES OF THE CONTEST

1. Every contestant shall be between sixteen and twenty-one years of age and shall be a resident of New York State.

2. Each contestant must obtain the approval of his parent or guardian and enroll with the district superintendent before beginning any work connected with the contest.

3. Each contestant must do all the work of preparing, planting, cultivating, and harvesting a vegetable garden of the above size, but he may make use of all the advice and information that he can secure.

4. Each contestant must grow at least fifteen vegetables during the season.

5. Each contestant must keep a complete and accurate account of the cost of labor, seed, fertilizer, rent, or other charges connected with the garden, and present the complete account, showing the profit or loss resulting, with his exhibit on prize day.

6. Before harvesting is begun the area on which the crop is grown must be measured by the district superintendent or his representative, and by the contestant, and the former must certify to the exact size of the area.

7. Two disinterested, responsible persons must certify on the record that the yields and prices recorded are correct.

8. Each contestant must choose a representative collection of vegetables from his garden for exhibit on prize day together with his records and essay. The award for the exhibit will be based on number of kinds; size, shape, smoothness of specimens; and general attractiveness of arrangement.

9. The following list of vegetables may be suggestive:

Beans
Beets
Cabbage
Carrots
Corn, sweet
Cucumbers
Lettuce
Onion seed
Onion sets
Parsnips
Peppers
Pumpkins
Radishes
Spinach
Squash, early
Squash, late
Tomatoes
Turnips, early
Turnips, late
Watermelons

10. A brief story, telling how the vegetables were grown, giving details of the work connected with them, and describing any particular features that were noticed by the contestant, must be submitted on prize day with the crop records and the exhibit of vegetables.

11. The results of the contest will be determined on the basis of the following score:

Total yield of garden produce	30 points
Profit shown	30 points
Exhibit of vegetables	20 points
Story of the garden	20 points

RECORD OF THE CONTEST

RECORD BLANK FOR VEGETABLE CONTEST—GARDEN 50 BY 100 FEET SECOND DISTRICT, TOMPKINS COUNTY

Name.............................Post-office address..................
Town........................Age of contestant..................years

(Draw plan of garden to scale on the back of this blank. Give particulars as to distance between rows and kind of vegetable in each row)

1. Kind of soil: Clay, sand, black loam, etc..................................
....
2. Preparation for planting: Describe, giving dates, tools used, etc.............
....
3. Manure or fertilizer used: Kind and amount..............................
....
4. Planting:

Name of vegetable	Variety	Date
....	....	....
....	....	....
....	....	....

(In the printed form sufficient lines should be here inserted to provide for all the vegetables grown)

5. Cultivation and care of garden: Give dates and tools used.................
....
6. Harvest list:

Name of vegetable	Dates harvested	Amount yielded	Market price	Value
....	....	....	....	....
....	....	....	....	....
....	....	....	....	....

(In the printed form sufficient lines should be here inserted to provide for all the vegetables grown)

Total value..............

7. Expense in time, labor, and money:
   Value of contestant's time at........cents per hour........... $........
   Value of work of horses at........cents per hour for each horse.. $........
   Other expenses itemized (seed, fertilizer, rent, etc.)..............
   .... $........
   Total cost of garden............................ $........
   Total value of product (as above under "6")....... $........
   Amount of profit or loss........................ $........

Date..............................Signed..................................
Contestant

I do hereby swear that I have measured the land on which the contestant,........ ...., raised the vegetables reported in this record, and find it to be 50 by 100 feet.

....
District Superintendent or Representative

I do hereby swear that the yield of vegetables raised on the above plot of ground by .... and the prices obtained are correct as reported. I further swear that to the best of my knowledge and belief all the rules of the contest have been faithfully and honorably observed.

First name..................................

Second name..................................

CULTURAL DIRECTIONS

Albert E. Wilkinson

For general directions regarding planning, fitting ground, sowing, and care of garden, see page 994.

Beans.— Beans thrive best in a warm sandy loam. Soils rich in nitrogen are not best suited to the profitable growing of this crop, owing to the fact that the plants will have a tendency to produce too much leaf and stem growth at the expense of the crop of pods. The bean is well suited for rotation with other garden vegetables, as it does not exhaust the soil of plant-food. Beans in heavy clay do not give satisfaction, as the soil after a rain forms a crust that may prevent the seedlings from coming up evenly.

Beans are tender plants and will not withstand a frost; therefore do not plant them until the soil is thoroughly warm.

Beans may be divided into two classes: pole beans, or those that require support; and bush beans, or those having a bush-like growth. In this garden contest only the bush beans will be considered.

Bush beans may be planted in rows eighteen inches apart if hand tillage is to be given. The seed should be covered not more than one inch deep. The plants in the row should be two to three inches apart. They may, however, be planted in hills, that is, three to five plants clustered together, with the clusters twelve to fifteen inches apart in the row.

Frequent shallow stirring of the soil is required, thereby destroying all weeds and maintaining a loose soil surface, called a mulch, to keep, or conserve, the moisture in the soil.

Beans should be picked only when the bushes and pods are dry. If picked when plants are wet, disease may set in, making the future pods undesirable.

For exhibition purposes, show only the best specimens as to shape and color, and those that are uniform in size.

Beets.— See page 997.

Cabbage.— See page 997.

Carrots.— See page 997.

Corn, sweet.— See page 998.

Cucumbers.— See page 998.

Lettuce.— Most varieties of lettuce thrive best during the early spring or late autumn. However, the cos, or summer lettuce, is an exception.

A rich sandy loam full of organic matter, such as rotted stable manure, is the best soil for lettuce.

Plant the seed one half inch deep in rows twelve to fifteen inches apart. Thin the plants so that they stand ten to twelve inches apart in the row.

In order to produce crisp, choice lettuce, there must be continuous rapid or forced growth. This means plenty of water and cultivation.

In harvesting cut the plant with a knife just below the place where the first leaves branch or start from the stem. Wash off the soil by placing in a tub of water, stem end first — never the other way. Place in baskets or boxes stem up.

Lettuce is a good crop to use for companion or succession cropping.

Onions.— See page 999.

Parsnips.— See page 999.

Peppers.— A good loamy soil, well manured, will produce good peppers. Plant the seed in a hotbed or cold-frame. Later transplant the seedlings to the field in rows eighteen inches apart, with fifteen inches between the plants in the row. For best results give clean culture and soil mulch.

Peppers are easily raised but are relatively slow growers. They thrive in warm weather and a long growing season.

Uniform green peppers should be chosen for exhibition.

Pumpkin.— This plant has been found to grow in almost every soil; but a good loamy soil that has had a generous coating of manure mixed with it and a forkful placed under each hill will surely produce good pumpkins. Pumpkins can be grown successfully in a field of sweet corn.

Plant four or five seeds in a hill. The hills should be ten feet apart in the row and the rows eight feet apart. Later, thin to two or three plants for each hill. Allow only one pumpkin to a plant for the production of the largest size. A pailful of water poured around the hill now and then will help, especially if the weather is not rainy.

Squash bugs may become pests. If so, place shingles on the ground near the plants; early in the morning the bugs will be found under them and can be destroyed.

Radishes.— A loose, rich soil, such as a sandy loam full of rotted manure, is the kind that radishes require. If they grow slowly they will have a sharp flavor and be tough and woody.

For a constant supply, plant radishes every two weeks. Plant them in rows twelve inches apart, and thin the plants to stand one inch apart or a little more.

Radishes can be grown between slower-growing plants, thereby obtaining two crops from the same land in the same year.

Clean culture must be given.

For all-season growth, producing a very large radish, try the Japanese Sakurajima, the Black Winter, or the White Giant Stuttgart. These varieties should be thinned so that the plants stand four inches apart.

For exhibition the well-washed red or white roots, with the green leaves, are attractive.

Spinach.— In order to produce good spinach, a rich loam that will give the plants a quick growth is required.

Plant the seed not more than one half inch deep in rows twelve inches apart. Thin the plants when three inches tall to six or seven to the foot.

Give constant clean culture. In gathering spinach the entire plant is removed. Choose the largest plants first.

Spinach can be used as a companion or succession crop in order to utilize waste ground in the garden.

For exhibition spinach should be washed in a tub of water, and the entire plant as it appears above ground should be shown.

Squash.— See page 999.

Tomatoes.— See page 1000.

Turnips.— See page 1000.

Watermelons.— Soil that has a large percentage of sand is required for watermelons. In addition to the regular manure, an application of a shovelful of well-rotted manure in each hill, similar to that used for cucumbers, would be an advantage.

Plant the seed one half to three fourths inch deep in hills eight feet apart each way, five or six seeds in each hill. Thin later to three plants in each hill.

Watermelons must be protected from the cucumber beetle until the foliage becomes toughened. The method of protection is described under "Cucumbers." See page 998.

Good cultivation should be maintained until the vines interfere.

When the melon is ripe it will have a hollow sound. Cut the stem, leaving a small part on the melon.

Planting table for all vegetables.— See page 1001.

6. Strawberries; 50 by 100 Feet*

RULES OF THE CONTEST

1. Every contestant shall be between sixteen and twenty-one years of age and shall be a resident of New York State.

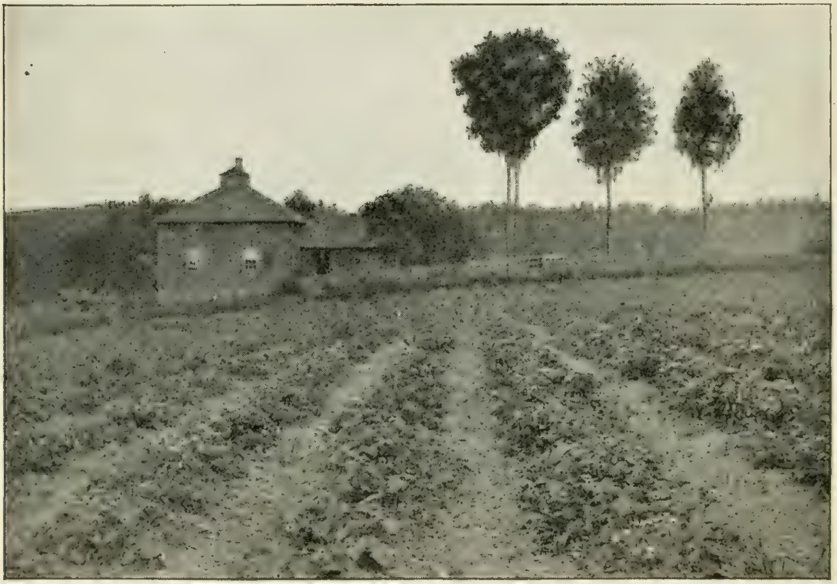
2. Each contestant must obtain the approval of his parent or guardian and enroll with the district superintendent before beginning any work connected with the contest.

3. Each contestant must do all the work of preparing, planting, cultivating, harvesting, and marketing the fruit from a strawberry patch 50 by 100 feet, but he may use all the advice and information that he can obtain.

* This is a two-years contest and perhaps will not be found practicable for some time. Ultimately, there is no reason why a contest might not extend over two or even more years.

4. Each contestant must keep a complete and accurate account of the cost of labor, plants, fertilizer, rent, or other charges connected with the crop, and present the complete account, showing the profit or loss resulting, as his exhibit on prize day.

5. Before harvesting is begun the area on which the crop is grown must be measured by the district superintendent or his representative, and by the contestant, and the former must certify to the exact size of the area.



A bearing patch of strawberries with the straw mulch removed from the rows in spring

6. Two disinterested, responsible persons must certify on the record that the yields and prices recorded are correct.

7. A brief story, telling how the crop was grown, giving details of the work connected with it, and describing any particular features that were noticed by the contestant, must be submitted on prize day with the crop records.

8. The results of this contest will be determined on the basis of the following score:

Total yield of strawberries....................	40 points
Profit shown..............................	35 points
Story of the crop..........................	25 points

It will probably be impossible to have an exhibit of the strawberries, so that this factor will have to be omitted from the score.

RECORD OF THE CONTEST

RECORD BLANK FOR STRAWBERRY CONTEST, PLOT 50 BY 100 FEET

SECOND DISTRICT, TOMPKINS COUNTY

Name............................Post-office address...................
Town......................Age of contestant...................years

1. Kind of soil: Clay, sand, black loam, etc..................................
2. Kind of crop previously grown...
3. Preparation of the soil..
   ....
4. Manure or fertilizer used, if any: Kind and amount.......................
   ....
5. Setting plants: Date.........................Variety....................
   Distance between rows...............................Distance between plants in the row..
6. Cultivation and winter care: Give dates of cultivation, with tools used........
   ....
   Give dates of putting on and taking off winter protection.................
   ....What material was used...................
7. Harvest:

Date	Quarts	Price per quart	Total
....	....	....	....
....	....	....	....
....	....	....	....
....	....	....	....

Total value.................

8. Expense in time, labor, and money:
   Value of contestant's time at..........cents per hour............ $........
   Value of work of horses at........cents per hour for each horse.. $........
   Other expenses itemized (plants, fertilizer, rent, etc.)............ $........
   Total cost of crop................................ $........
   Total value of product (as above under "7")....... $........
   Amount of profit or loss........................... $........

Date..................................Signed..................................
Contestant

I do hereby swear that I have measured the land on which the contestant,.......... ...., raised the strawberries reported in this record and find it to be 50 by 100 feet.

....
District Superintendent or Representative

I do hereby swear that the yield of strawberries produced on the above plot by .... has been measured in my presence and that the amounts reported, together with the prices obtained, are correct. I further swear that to the best of my knowledge and belief all the rules of the contest have been faithfully and honorably observed.

First name......................................

Second name....................................

CULTURAL DIRECTIONS

H. B. Knapp

Strawberries require a loose, rather light, warm soil. The soil should also be rich and moist. The plants should usually be set in the spring. Spring-set plants will produce a good crop the following summer. Strawberry plants may be obtained either from old patches or direct from the nurserymen. They may be obtained in lots of one hundred for sixty to seventy-five cents. There are any number of varieties that are satisfactory, but it is often the case that a single variety of strawberry, when grown alone, will not set fruit. This is because the blossoms are self-sterile, as we say; that is, the pollen from the flowers of a variety will not fertilize the flowers of the same variety. This is not true of all varieties, however, and those that are self-fertile, or perfect, are always so designated in the nursery catalogues, being accompanied in this case by the letter " P," meaning perfect. In the case of the self-sterile, or imperfect, variety, it is necessary to set two or more varieties in the same patch in order to be sure of cross-fertilization.

A strawberry plant ready for the field

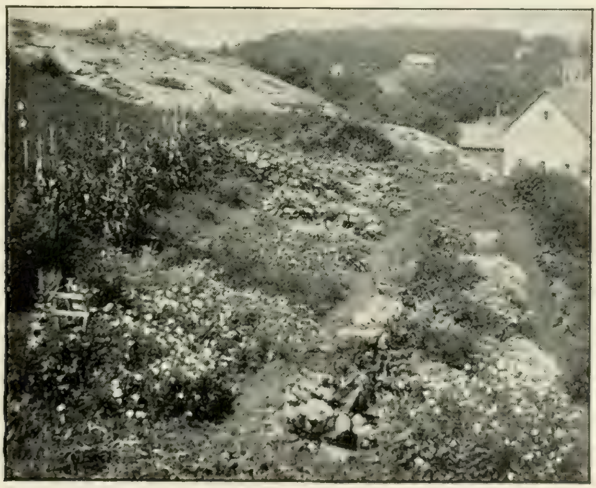
The plants should be set early in the spring on land in good tilth which has been occupied by a cultivated crop the previous year. In no case should strawberries be set on sod ground, for the white grub, which is one of the most serious enemies of this fruit, flourishes in sod. The plants should be set in rows three and one half to four feet apart, and about eighteen inches apart in the row.

Clean and thorough cultivation should be given during the entire summer, the purpose being to obtain a large amount of vegetative growth the first year. If blossoms appear and fruit is set, it should be pinched off. The amount of fruit that would be borne in any case would be slight, and the vitality that would be used in developing the fruit might better go into the plant itself. It is highly important that the patch be kept clean and free from weeds; during the first year frequent hoeings will

probably be necessary. As the plants grow they will put forth runners, on which sets, or young plants, will be formed. These runners should be placed by hand in such a position that they fill up any vacant spaces. thus increasing the width of the row until it is twelve to eighteen inches across It may be necessary to remove completely some of these runners, or stolons.

In most cases a little winter protection is desirable. This is very important when the patch is situated in an exposed place, where the snow does not remain long enough to form a permanent covering. A mulch of coarse straw may well be applied, just before winter sets in, in order to protect the plants from the severe cold and also to prevent alternate freezing and thawing. There is considerably more danger of applying this mulch too thickly than too thinly, because it is very easy to smother the plants. A mulch two or three inches in thickness is entirely sufficient and some coarse material is best. This mulch should be removed early the succeeding spring and allowed to remain between the rows. If the bed is not mulched, cultivation should be begun early in the spring before the blossoms appear. Strawberry beds should never be worked during blossoming time, as there is great danger of blasting the flowers; and unless there is a layer of straw or some other material between the fruit and the soil, the berries very often become covered with dirt during heavy rains.

Strawberry patches are usually not allowed to bear for more than one year, because the growers find it more easy and more profitable to set a new patch than to attempt to keep the old one clean after the first year.



GROUP III. CONTESTS FOR GIRLS

To the District Superintendent:

To train the girl for efficiency is quite as essential as to train the boy. The Empire State must give the girls every opportunity to be useful and happy and to take their part in making our State one in which are found the bravest, strongest, most efficient and womanly women in the world. The girls must have help and must be inspired to meet life's responsibility.

One way in which we can help our girls is to have them consider the importance of their contribution to the home life. They should realize how valuable the expert housewife is in the world, and should be taught to take an interest in some of the simple processes that help women to make a rich contribution to any home.

In order to awaken interest in the work of the home, we hope that there will be simple, wholesome contests for the girls in every school district in New York State. In the foregoing pages we have suggested

contests for both boys and girls. There are some lines of competition that will doubtless be of interest to girls only. For a beginning we shall suggest a few simple contests.

The most important thing to be considered in any contest is leadership. Whenever children's contests have been a success, it is because the leader did his part and remained true to the cause until the end. We therefore suggest that this matter be considered most seriously in connection with all work with the girls.

It will be best to have a woman in charge of the girls' contests. If the right person can be found she will be of inestimable value to the group of girls. Can you not find some public-spirited woman who is a good housewife, who can cook and sew, who is a real power for good in the neighborhood, who will cooperate with the teacher, or even by herself encourage the girls to meet with her; to talk over the contests suggested in this leaflet; to make ready to do one concrete piece of work in competition with one another? One woman to work with the group of girls will accomplish more than a committee; a number of girls working together with the sympathetic aid of one capable person will do more than a club that becomes involved in organization. Any one of the splendid women now in the grange, who is reaching out in helpful ways, will doubtless be ready to work with the district superintendent and the teachers to make the contests a success.

In this first leaflet issued in the interest of contests, we are presenting very simple work. If the suggestions are followed, however, foundation will be laid for more advanced work in the future. A beginning in which the entire community becomes interested is important. The girls should enter all contests with the feeling that each will do her best and that a fine character will meet the results of the contest in a high-minded way. To win a prize is always gratifying; but the piece of work is of greater value than the prize. In fact, the most important feature in children's contests is that with right leadership character can be taught in many ways.

Following are directions for the various contests that will apply to both groups of girls: twelve to sixteen years old, and sixteen to twenty-one. Although the instruction given is the same for all contests, the results of the work will need to be exhibited and judged in at least two groups, as suggested above.

One thing that the girls should consider seriously, while preparing for the contests in cooking, is that, while the exhibits may be prepared in a short time, success will doubtless depend on the amount of experiment and practice.

THE EDITORS

1. Bread-making Contest

RULES OF THE CONTEST

1. Every girl entering this contest must be between twelve and sixteen years of age for Class I, and between sixteen and twenty-one years of age for Class II.

2. Each contestant must obtain the consent of parent or guardian and enroll with the district superintendent before beginning any work in this contest.

3. Each contestant must do all the work connected with making the liquid yeast and the loaf of bread, but each may use all the advice and suggestions that it is possible to get from more experienced persons.

4. Each contestant must exhibit on prize day a single loaf of bread of her own making.

5. Each contestant must write an essay, telling how the bread was made, giving details of the work connected with it, and describing any particular features that were noticed. This essay must be submitted on prize day, with the loaf of bread and the affidavit.

AFFIDAVIT

(Local information should be given here)

Made by.............................Post-office address.......................

Age.................years

Date......................Signed...
(Contestant)

I do hereby swear that to the best of my knowledge and belief Miss.............. ....has made this loaf of bread and written this essay herself, and has faithfully and honorably observed all the rules of the contest.

First name.....................................

Second name....................................

YEAST AND BREAD-MAKING

Flora Rose

Bread-making is as truly " farming " as is growing corn or other crops. The seed planted is yeast, the field is flour and water, and the crop that we hope to reap is a fine lot of healthy yeast-plants. Many persons do not know that yeast is a plant, for it is so small that it cannot be seen with the naked eye. Under the microscope it looks like a little round or oblong, half transparent, living thing, having neither roots, leaves, nor stem, but able nevertheless to feed and

grow and form new yeast-plants. If you could look for some time through a microscope at some healthy, growing yeast-plants, you would see a very interesting process. Tiny round buds would appear on the sides of some of the plants, and after a while these would become as large as the parent and send out buds of their own, until finally, if the conditions were right, there would be a little colony of many plants.

Although you cannot see these tiny living things without the aid of a good microscope, you do not have to depend on seeing them in order to know that they are there and to learn many things about them. It is easy to plant a yeast garden and to raise a good crop quickly if you supply the right conditions, for healthy, vigorous yeast-plants grow rapidly, and you soon know that they are at work because of the changes that take place in the field in which you have planted them. Wherever they feed they produce a change known as fermentation, and you are familiar with this in rising bread-dough and in spoiling fruit.

If you are to be successful in raising good yeast you must know how to feed it and to care for it, because, like any other crop, it needs looking after. Food, air, moisture, and warmth are all necessary for the growth of yeast, and if it is to thrive well it should be planted in a well-weeded garden.

Originally all yeast was wild, but that used by man to-day is carefully cultivated by persons who make it a special business to grow these little plants and put them up in a convenient form for sale. Wild yeasts are very abundant and flourish particularly on fruits, about fruit trees, vines, and bushes, or wherever there is any sweet solution to feed on. The foods best liked by yeast are those containing some form of sugar, as fruit juices, molasses, and dilute sugar solutions; and yeast grows well in a mixture of flour and water, for the dough contains enough sugar to satisfy the yeast-plant. In feeding on sugar, yeast converts it into alcohol and a gas known as carbon dioxid. This gas causes spoiling fruit to bubble, but it is useful in bread-making for it gets caught in the meshes of the dough and stretches it, causing it to rise. If the crop of yeast-plants in bread-dough is good and vigorous, there is a large yield of carbon dioxid and the bread rises well and is light.

Yeast cannot stand much heat, and if it is sown in a field of very hot liquid it is quickly killed. This is particularly true of the cultivated yeasts used in bread-making, for the wild yeasts are likely to be more hardy. If we are canning fruits it is very desirable to boil them so as to destroy any wild yeast that may be present, for in that case the yeast is a weed because it is growing where it is not wanted. In making bread, however, we must be careful not to have the liquid hot, since it is our desire to make the yeast grow. The temperature most favorable to the

growth of yeast is 70° to 90° F. It may be lower than this, and in that case the yeast grows slowly; or it may be somewhat higher, but this condition may weaken the yeast and thus make it a prey to its enemies.

The enemies of the yeast-plant are just as small and invisible as the yeast-plant itself, but we must not take it for granted that they are not present because we cannot see them. They may be found on soiled towels and hands or on unclean utensils; in milk and water and poor flour; and if they get into our yeast garden they may choke out the yeast and grow in its place. Then, if we are using the yeast to make bread, instead of having sweet, well-risen bread we shall find a sour, poor loaf that is neither good nor wholesome. If the yeast is to grow vigorously and produce new plants, it must have not only food but also considerable moisture. It may be kept alive for a long time in a dry state, but in that condition it will be quiet and inactive. The dry yeast-cake and the compressed yeast-cake so familiar to housekeepers are fields of dried-out yeast-plants, alive but inactive and requiring only moisture, warmth, and food in order to start fresh growth.

In former times bread was made light by setting some dough in a warm place until it began to ferment. That was before anything was known about yeast, and no one dreamed then that the fermentation was due to certain little wild yeasts that had found their way from the air into the dough. That was not the surest way of making good bread, for while the wild yeast was getting in there was nothing to keep the other little living things out and the bread was often sour and unwholesome. Carefully weeded fields of cultivated yeast-plants are now within the reach of every one in the form of either dry or compressed yeast-cakes, and it is no longer necessary to depend on wild plants to do the work. The housewife often makes what she calls a " starter " and uses this in place of the yeast-cake in making her bread. The starter is made by planting yeast in a field that contains just enough food to make it begin active, vigorous growth. If starter is used the bread rises much more quickly than when dry yeast is used, because the yeast-plants are more numerous and more active in the liquid starter than in the dry yeast-cake. Sometimes a little of the sponge is saved from one baking to another, and this sponge is used for making the bread light. It is just like saving seed from one crop in order to start a new crop. Bread made from left-over sponge is less likely to be good than when specially prepared yeast is used.

There is no process in household management that is more interesting than bread-making, for it deals with living, growing things. Proper care and an understanding of conditions will, as a rule, insure good results; and when bread fails to be good there is always the consolation of knowing something of the cause of failure — either poor, weak yeast-plants, or

poor flour, or lack of cleanliness in milk, hands, or utensils, or too much heat or cold, or too long rising.

After bread has risen and is light, the work of the little yeast-plant is accomplished; and not only is it no longer needed, but its presence spoils the bread. So we bake the bread, and bake it long enough to kill all the yeast present. This is not always done well, however, and in many homes badly baked bread, having many live yeast-cells in the center of the loaf, is a common occurrence.

In making leavened bread, wheat flour or flour made from some other grain having a substance called gluten must be used; for gluten is very elastic and does not break when stretched by the gas bubbles, and so it can hold the gas formed and a fine, light, porous loaf of bread results. A cereal such as oatmeal cannot be used by itself in making bread, for it is not elastic, but sticky, and the gas bubbles will quickly escape.

Suppose you try to plant a yeast garden, grow some yeast-plants of your own, and then make a loaf of bread.

How to make liquid yeast.—

2 potatoes, ½ cup salt
2 quarts water, 1 cup sugar
1 cup loose hops or 2 tablespoons package hops
1 yeast-cake softened in 1 cup water or
1 cup liquid yeast

Grate the potatoes into the water.

Add salt, sugar, and hops, and boil until the potatoes are clear.

Pour into a clean earthenware jar or other receptacle, filling not more than half full, and set in a cool place.

When the mixture is lukewarm add the softened yeast-cake, cover with a clean cloth, and set in a warm place to rise.

Twelve to twenty-four hours will accomplish this.

Stir occasionally while rising.

When well risen, cover with a clean plate or other cover and set away in a clean, cool place. A freezing temperature will destroy the yeast-plants.

With care, liquid yeast made under clean conditions will keep in good condition for two weeks or more.

When more liquid yeast is to be made, a cup of liquid yeast may be used to start it in place of dry yeast.

How to make bread.—

For one loaf of bread use:

½ pint milk, ⅓ cup liquid yeast
1 teaspoon salt
Flour to make a dough (about 3 to 4 cups)
½ tablespoon butter or lard

Have hands, cloths, and utensils scrupulously clean. Boil the milk once, pour into bowl or receptacle in which bread is to be mixed and in which it is to rise, add salt, butter, and sugar, and then let cool until about lukewarm. After the milk has cooled add the yeast and enough flour to make a batter, then beat the batter well so as to put in plenty of oxygen — for the yeast-plant grows best when it has oxygen to use. Cover with a clean cloth and set in a warm place until light. When the batter is light add enough flour to make a dough, turn the dough out on a kneading-board, and knead until the dough is no longer sticky. We cannot tell you how much flour to use at this time, for different kinds of flour vary greatly in the amount of water that they take up; but do not make the dough either very stiff or very soft. Sufficient flour should be used to make the dough stiff enough so that it will need no more flour during the bread-making process. After rising, the bread should be kneaded on a clean, unfloured board. Flouring the board later makes rings and circles in the loaf, which cause it to split in sections when cut. After kneading put the dough back into the same bowl or pan in which the sponge was made, cover, set in a warm place, and let the dough rise until it is a little more than double its bulk. Shape into a loaf on an unfloured board, put into a greased bread pan, cover, set in a warm place, and let the dough rise again until it has about doubled its size. It should feel light and very elastic. Bake at once in a moderately hot oven for forty-five to sixty minutes. This will not make a large loaf of bread; but we hope you are going to learn to make and to like the small loaves of bread, for they are easier to bake through, and they have a large amount of good, wholesome crust.

If liquid yeast is used, this bread may be started in the morning and will be ready to bake with the supper fire; or it may be allowed to rise overnight and may then be baked sometime during the morning or early afternoon. The longer or the more often bread rises, the more elastic and the more like baker's bread it becomes. If it rises too long it becomes sour.

A good loaf of bread should be evenly porous; should have a sweet, nutty flavor; should be thoroughly baked; should have no odor nor taste of yeast; the crumb should be tender and elastic; the crust should be well browned; the bread should be so palatable as to encourage the family to make it a prominent feature of the meal.

It must not be thought for a moment that the only way to make bread is the way given here. A set recipe has been given for both yeast and bread, because, if bread contests are to be held, all the loaves should be made as nearly alike as possible so as to compare them easily.

Bread, like other foods, may be varied in numerous ways:

Water may be used in place of milk, in which case the bread is tougher and grayer in color than when made with milk.

Potato water, boiled whey, thin gruels, are also used as liquids in making bread. These substances seem to produce a loaf of bread that is both moist and tender.

Whole wheat flour, graham flour, and small quantities of oatmeal, corn meal, or other cereals are often used for modifying or changing the character of bread.

Bread is frequently mixed directly into a dough and is then allowed to rise only once before being shaped into the loaf. This saves time and the results are nearly as good as when the batter is made and allowed to rise first.

A crumbly crumb is obtained by increasing the amount of shortening.

SCORE CARD FOR BREAD

Flavor, taste, odor		40 points
Texture of crumb	Lightness, Doughiness, Moisture, Color	40 points
Texture of crust	Hardness, Depth, Color	10 points
Form and size of loaf		10 points

The exhibit of each contestant will be judged on the following basis:

Loaf of bread	80 points
Essay	20 points

2. Contests in Canning and Jelly-Making

Class I. Twelve to sixteen years of age.
1. Can of cherries or crab-apples.
2. Can of tomatoes.
3. Apple or currant jelly.

Class II. Sixteen to twenty-one years of age.
1. Can of tomatoes, grown and put up by the girl.*
2. Exhibit of four cans of different fruits.
3. Exhibit of three different kinds of jelly.

RULES FOR THE CONTEST

1. Every girl entering these contests shall enter in the proper class according to her age.

2. Each contestant must obtain the consent of parent or guardian and enroll with the district superintendent before beginning work in any of these contests.

3. Each contestant must do all the work connected with the contest for which she is entered.

4. Each contestant must submit on prize day the exhibit called for by the contest in which she is entered.

5. Each contestant must write an essay descriptive of the work done in preparing the exhibit, and submit it on prize day together with the exhibit and the affidavit.

AFFIDAVIT

(Local information should be given here)

Made by............................Post-office address......................

Age...............years

Date............................Signed................................
(Contestant)

I do hereby swear that to the best of my knowledge and belief Miss..................................has canned the fruit (made the jelly) and written this essay herself, and has faithfully and honorably observed all the rules of the contest.

First name..

Second name..

* A simple record of the experiences in growing the tomatoes should be required in this contest. For cultural directions see page 1000.

DIRECTIONS FOR CANNING AND JELLY-MAKING

Helen Knowlton

Department of Home Economics

For many years you have watched your mother when she has canned fruit or made jelly. Probably you have helped her and perhaps some of you have tried to do it alone. We are going to suggest that you try both canning and jelly-making, and enter the results for the girls' contest in your district. This explains the list of contests that you have just read.

Why should you learn to can fruits and to make jelly? Long ago it was found that raw fruits would not keep well, but that if cooked with sugar and sealed they could be used and enjoyed in January as well as in summer. It was also found that adding more sugar to the juice, and cooking, would produce jelly that would keep without being sealed.

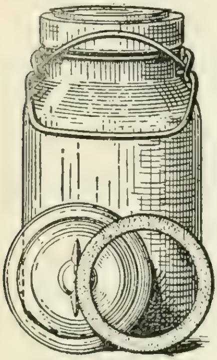
What is the secret of these two processes? It has been found that there are certain tiny plants, too small to be seen except under a microscope. These may be either bacteria or yeasts. There are also molds, which we can see, but the bacteria and yeasts are fully as important and perhaps more so. All of these cause fruits to spoil. In order to preserve fruits, therefore, the tiny yeasts and bacteria and molds must be killed. They are found everywhere — on the fruit, in the air, in water, and on the dishes used in canning fruit. They can be killed if you heat fruit and dishes long enough. When you heat the dishes, water, fruit, and the like you have *sterilized* them. By sealing the canned fruit the tiny plant-forms are left out.

The jelly can be covered with paraffin, which will protect it from molds. Jelly has so much sugar that usually bacteria and yeasts do not grow well in it. If you were planning to can vegetables you would need to have special directions, because some of the tiny plant organisms on vegetables are very hard to kill. In canning it is just as important to sterilize the jar, the cover, and the rubber ring by heating, as it is to sterilize the fruit. The inside of the cover must not be handled after it has been sterilized, not even with clean hands, because by so doing hundreds of organisms might get into the fruit. For the same reason, do not put an unsterilized knife or spoon into the jar.

CANNING OF FRUIT

Canning materials.— Only good, sound materials should be used in canning. Coarse-grained sugar should be chosen for canning fruits and for jelly-making, as it melts without so much frothing as is produced by fine-grained sugar.

Preparation of fruits for canning.— The directions here given should be followed in the preparation of fruits for canning:



Spring-top jar

1. Select well-grown, firm, and not overripe fruit.
2. Avoid very dirty fruit.
3. If possible, can fruit on the day picked.
4. Prepare fruits for cooking, in the following manner:

a. Clean thoroughly.

b. Pare or peel, as the kind of fruit requires.

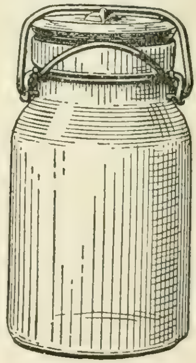
c. Remove all bruised or decayed parts.

d. Wash and halve, quarter, or slice, as desired, before putting into cans or cooking utensil.

e. If the fruit is of a kind that discolors after being pared, cover with cold water until ready for use.

Methods of canning.—

Method I. To be used when natural flavor is the object, and a rich, highly sweetened product is not desired.

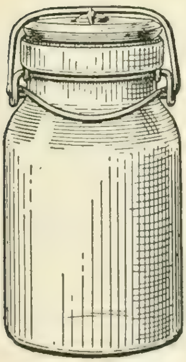


Position of spring during sterilization

1. Pack the prepared fruit firmly in the can to within one half inch of the top. Care should be taken not to bruise, injure, nor crush soft fruits.

2. Add sugar according to the fruit canned. For each quart-can of fruit use:

To make very sweet, 1 cup, or 8 ounces, of sugar.



Position of spring after sterilizing

To make moderately sweet, $\frac{1}{2}$ cup, or 4 ounces, of sugar.

To make slightly sweet, $\frac{1}{4}$ cup, or 2 ounces, of sugar.

Can tomatoes without any sugar.

Make a sirup by cooking the sugar with water for 1 to 2 minutes, using $2\frac{1}{2}$ to 3 cups of water for each quart of fruit.

3. Fill the can completely full of sirup.

4. Place a new rubber on the can and adjust the top of the can, but *do not seal it.*

5. Place cans on slats of wood or other perforated support in the bottom of the boiler or cooking vessel.

6. Pour enough cold water into the vessel to cover jars to a depth of two to three inches.

7. Bring the water to the boiling-point and boil for 20 to 30 minutes, according to size of the jar and hardness of the fruit.

8. Seal the can.

9. Remove cans from the vessel, set them aside out of any draught, and let them cool.

10. Wash outside of can thoroughly, label, and set away.

Canning outfit

TABLE OF DIRECTIONS

Food	Special preparation before canning
Apples	Peel, quarter, and core
Blackberries	Remove stem, leaves, trash, and imperfect berries
Cherries	Seed or leave whole
Grapes	Pick from stem
Huckleberries	Remove leaves, trash, and imperfect berries
Peaches	Peel, can whole, in halves, or in quarters
Pears	Peel, cut in halves or quarters, and core
Plums	Leave whole or cut in halves
Quinces	Peel, quarter, and core
Raspberries	Remove stems
Rhubarb	Cut in $1\frac{1}{2}$-inch pieces
Strawberries	Stem
Tomatoes	Scald. Remove skins. Save any juice escaping

Method II. This method is best with watery foods that are easy to sterilize, when concentration is desired, or when the richness of sugar-soaked fruit is an object.

1. Sterilize cans, tops, and rubbers by covering with cold water, heating gradually, and boiling for 20 minutes. Old cans, carelessly cleaned, are a frequent cause of spoiled food, hence the precaution of boiling the cans is wise.

2. For each pound of fruit use:

For preserves, $\frac{3}{4}$ pound of sugar.
To make very sweet, $\frac{1}{2}$ pound of sugar.
To make moderately sweet, $\frac{1}{4}$ pound of sugar.
To make slightly sweet, $\frac{1}{16}$ to $\frac{1}{8}$ pound of sugar.

3. The amount of water required for cooking fruit by this method will vary with the juiciness of the fruit and the amount of sirup desired with it.

For each pound of fruit use:

If very juicy, $\frac{1}{8}$ to $\frac{1}{4}$ cup of water.
If moderately juicy, $\frac{1}{4}$ to $\frac{1}{2}$ cup of water.
If slightly juicy, $\frac{1}{2}$ to 1 cup of water.
Make sirup and add fruit to it.

4. Cook the material to be canned.

a. For tomatoes, stew or steam until tender, 20 to 60 minutes, without sugar.

b. For fruits:

(1) Cook in sirup until tender. If fruits are tough, steam until tender, then cook in sirup until slightly clear.

(2) If juicy, tender fruits are used, they may be covered with sugar until the juices begin to draw and may then be stewed until tender.

(3) If fruits cook to pieces readily, cook in a moderately heavy sirup.

5. Adjust rubber, and fill hot, sterile jar completely full with hot cooked fruit or vegetable.

Types of jars for home use

6. Cover and seal at once. Be careful not to handle the *inside* of the cover.
7. Invert can and let it stand until cool.

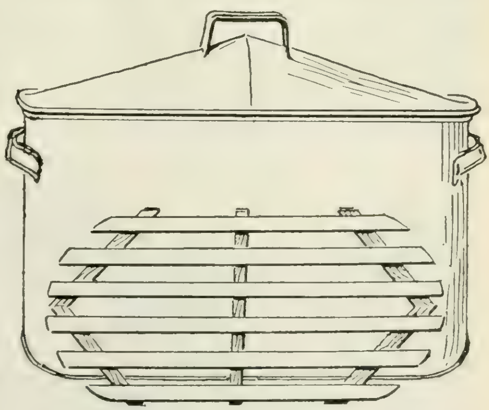
Manner of testing

Jars, or cans.— Use pint jars for two reasons: first, if you all use the same size, your jars can be judged more fairly; second, you will be more sure of success, because it is much easier to put up a pint than a quart. A quart jar should be heated more than twice as long (Method I) as a pint jar, and a two-quart jar at least five or six times as long.

Rubbers.— Use new can-rubbers and be sure to have good ones. They should not be stiff, inelastic, nor hard, for they must fit snugly in order to keep out the tiny plant organisms.

Testing a jar.— Before canning, test your jar by filling it partly full of water, placing on the rubber and the cover, sealing, and then inverting the jar. If it leaks, find out whether it is because of a poor rubber or an imperfect jar. If the rubber is at fault, throw it away; if the leaking is due to the jar, use it for something that does not need to be sealed.

Other utensils.— If you try Method II in your canning, be sure to use an agateware or aluminum saucepan or kettle for cooking. Use wooden spoons or silver spoons, never tin nor iron. If you have occasion to use anything for dipping, an aluminum cup or an earthenware cup should be used. If you try Method I, which is newer and better, use a saucepan or a kettle that is large enough for all the jars. Ask your brother or your father to make a little wooden rack to put in the bottom of this kettle, on which to set the jars while they are being heated. All that is needed is a few flat strips fastened by two or three cross-pieces, near enough together so that the jars will not fall through. In the illustration on this page is shown one large enough for a boiler. If you are handy with a hammer, make the rack yourself. Put the jars in so as not to touch one another, as touching might cause them to crack.



Sterilizer, showing false bottom as a rack

Storing canned food.— Canned food should be stored carefully, as light has a chemical action on some foods and destroys color, leaving the food unattractive in appearance.

If you can the fruit in the early summer and keep it in good condition until September, the judges will give you credit for work well done.

Cause of the spoiling of food in the can.— If the contents of the can and the can itself have been made absolutely sterile, and the can is entirely air-tight, the food will not spoil if held in a warm place. The spoiling of food under such conditions must be owing to one of three things:

1. Some flaw in the can, which makes it a so-called "slow-leaker."
2. The presence of some organisms that have survived the cooking process in spite of all care.
3. A drying-out of the rubber, and hence the breaking of the seal.

Testing canned food.— Canned food should be set aside for two or three days before storing, and then should be tested as follows: Loosen the clamp and grasp the can by the edges of the glass top. If sterilization has not been complete, if the can leaks, or if decomposition has set in, the top will come off. If the top stays on, tighten the clamp again and the food is ready for storage. If the top comes off, reject that can.

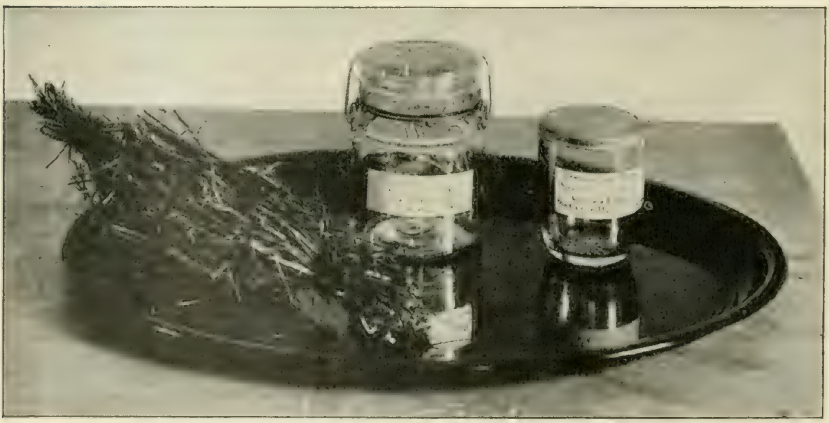
Opening the jar.— Run a knife-blade under the rubber and press firmly; if the top resists, pour a stream of hot water over it.

Marking the jar.— Label cans neatly as follows:

Canned Tomatoes

August 14, 1912

Mabel Allen 13 years



Cans correctly labeled and straw packing for transportation

Notice in the illustration, page 1060, the height at which the labels were placed on the side of the jar. Credit will be given for care in labeling.

MAKING JELLY

Currant jelly.—

1. Use currants that are not overripe, if you can get them.

2. Wash. It is not necessary to stem the currants, but if this is done the jelly will be a little clearer.

3. Place in an agateware or aluminum kettle or saucepan, and add ½ cup of water to 4 or 5 cups of currants.

4. Cook rather slowly. Stir occasionally with a wooden or silver spoon. When the simmering point is reached, crush the currants with a well-soaked wooden masher and then continue cooking until the whole mass is cooked through.

5. Have ready a piece of cheesecloth or a cheesecloth jelly-bag. The latter is made in the shape shown in the illustration and is very convenient.

Jelly-making outfit

The jelly-bag should be hung, if possible, at three places so that the top will not have to be held open. The illustration shows it hung at two places only. If you use a piece of cheesecloth, be sure to have it large enough so that you can tie the opposite corners together and hang it up. Transfer the cooked fruit to the bag, which has been wrung out of hot water. If you use the cloth, put it over an earthenware bowl after it has been wet. Let the juice drain into an earthenware or enameled-ware dish. *Never* use tin. Do not squeeze the bag or cloth After the fruit has drained for a half-hour or more, you are ready to make jelly.

6. Put the juice into a clean saucepan and boil for 5 minutes. Then measure the juice. Have ready some sugar which has been thoroughly heated in a shallow pan in the oven. To each cupful of juice add 1 cup

of sugar. If the currants were picked just after a rain, add a little less sugar, perhaps $\frac{3}{4}$ cup. Stir the mixture frequently so as to keep it from burning.

7. *Tests.*— There is no absolutely sure test in jelly-making, but there are two that will help. The first is to put a few drops of the mixture on a cold dish and let it cool. If cooked enough, it should jelly. The other is to drop the mixture from your spoon and see whether it "jellies," or breaks off as it drops. The second test is somewhat better because it is quicker and the jelly mixture has less opportunity to get overcooked while the test is being made.

8. If any scum appears during the first or the second cooking of the juice, remove it.

9. When the jelly stage is reached, take the saucepan from the stove and let the jelly stand until absolutely quiet before pouring into the tumblers.

10. The tumblers should be clean and hot when the mixture is added. If you put them into a baking-pan and place them in the oven for 5 or 10 minutes until they are thoroughly heated, they will be ready to use. Do not take them from the oven until you are ready to pour the juice.

11. When cool and "set," pour melted paraffin over the top of the jelly. You will find it convenient to keep a small agate saucepan, such as is shown in the illustration, for paraffin only.

12. Mark the jelly neatly, as described under "Canning."

Special points in making apple jelly.— Follow the directions as given for currant jelly, with these exceptions: Cut apples into quarters, throwing away any unsound parts. Do not core nor pare. Cover with water. You will not need to mash the apples. Boil juice at least 10 minutes before adding sugar. For each cupful of the boiled juice, add $\frac{3}{4}$ cup of sugar.

Second-extraction jelly.— Some time you may like to try adding enough water to cover the pulp that is left, and then boiling this again in order to extract more juice. Proceed as before, but add a little less sugar to the boiled juice. The reason why jelly can be made out of this second juice is because there is in it some of the substance that causes jelly to form. This is a gummy substance known as pectin, which is not all taken out of the fruit in the first boiling. If you try this second-extraction jelly, send in the tumbler marked Extraction II along with your regular tumbler.

SCORE CARD FOR CANNED FRUIT

Flavor, taste	40 points
Appearance, color, keeping of form of fruit, keeping qualities of fruit	45 points
Marking of jar	5 points
Written report	10 points
	100 points

SCORE CARD FOR JELLY

Texture	35 points
Flavor, taste	30 points
Clearness, color	20 points
Marking of jar	5 points
Written report	10 points
	100 points

3. Contests in Sewing

To the District Superintendent:

We shall be unable to publish material for sewing contests in this leaflet, but we hope that next year we can send directions to all who wish to conduct such contests in their districts. To those who are planning to encourage the girls to become interested in small competitions along this line, the following may be helpful:

For a number of years prizes have been given at the county fair for needlework. Doubtless, in every rural community work of this kind has been exhibited, and all persons who are expert in any line of sewing can help the girls who wish to make entries in a sewing contest. If the plans for interesting the girls are well organized and the leader has perseverance, the entire neighborhood will be benefited.

In arranging sewing contests, there should be at least two groups of exhibitors: girls from twelve to sixteen years of age, and girls from sixteen to twenty-one. It is so worth while to interest the little children in handwork that in some communities it may be thought best to make a third group of the children under twelve years.

The kind and quality of the exhibits will depend on conditions in the community. The work should be so planned as to give encouragement to the greatest number of young persons.

An outline prepared by the State Education Department will furnish suggestions for the contests in sewing. For the younger girls, the following should be considered:

Knotting	Knitting
Braiding	Crocheting
Netting	Basketry
Beadwork	Weaving

The older girls will be interested in some of the following:

1. Samples of different stitches: Blanket-stitch; running and basting stitch; cross-stitch; backstitch; hemming; overhand stitch; featherstitch; herringbone; Kensington stitch.

2. Simple construction of articles, using: French seam, placket, bands, buttonholes.

3. Patching and darning.

4. Quilts. Service and beauty should be considered, as well as fine needlework.

5. Aprons, undergarments, house dresses.

The foregoing suggestion for a sewing contest may help in starting the work this year. The person in charge of such a contest will be able to prepare a record blank and rules when the work for the contest has been definitely planned. Next year we shall try to send a leaflet specially prepared for contests in sewing.

THE EDITORS

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FOR INFORMATION REGARDING AGRICULTURAL CONTESTS AND FOR COPIES OF THIS LEAFLET, APPLY TO THE EDITORS OF THE CORNELL RURAL SCHOOL LEAFLET, COLLEGE OF AGRICULTURE, ITHACA, NEW YORK.

GOLDFINCH

SUPPLEMENT TO
CORNELL RURAL SCHOOL LEAFLET
VOL. 6, NO. 5, MARCH, 1913

CORNELL

Rural School Leaflet

[FOR BOYS AND GIRLS]

Published monthly by the New York State College of Agriculture at Cornell University, from September to May, and entered as second-class matter September 30, 1907, at the post office at Ithaca, New York, under the Act of Congress of July 16, 1894. L. H. Bailey, Director

ALICE G. McCLOSKEY and EDWARD M. TUTTLE, Editors

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Vol. 6 ITHACA, N. Y., MARCH, 1913 No. 5

A CHAT WITH BOYS AND GIRLS

ALICE G. McCLOSKEY

It is good for every one to think of country places and to hear about them. It is better still to live in them; for when we are near to open fields or dim forests where there are bird songs or music-filled brooks or the sound of singing winds, the world always seems more wonderful.

The house in the country

Not many miles from the College of Agriculture there is a farm that seems to me the best place in the world for boys and girls. It is a fruit farm and you should see the apple harvest — more kinds of apples than you could learn the names of in a long time; there are peaches, too, and juicy, luscious pears, and indeed many kinds of fruit that I cannot take the time to mention.

I want to tell you about the house on this farm; it is so good to look at and to live in. It is built of native limestone and some boulders. Wise men tell us that the boulders reveal a story of a time long, long ago when this part of the country was covered by glaciers. Have you ever thought that you would like to study about land forms and know something of the hills and the valleys and the strange rocks on your farm?

But to go back to the house that I am telling you about. If you look closely at the gray rocks that form the main outside walls, you can find in them many interesting fossil forms of animals that once lived in and by the sea. How do you suppose these forms came to be in this part of New York State? Some of you have heard of fossils. What can you find out in some good reference book about them? Did you ever find one on your own farm and would you like to know something about it? If so, send it to us and we will share with you the interesting story that it may be able to tell.

Inside the gray stone house there is a large fireplace. Isn't a fireplace one of the best things in the world? You and Fido and the gray kitten all like one. If you ever build a house, remember to have a fireplace. You will then be glad if some one has taken care of the woodlot so that there will be a splendid yule log to burn every Christmas. By the way, look at the woodlots in your neighborhood. Do you think there will be tall trees in them when you grow up?

I wish I had time to tell you about the creeks and all the brooks and rills on the farm that I love. They make such good comrades for boys and girls and, indeed, for older folk. There are many of them on this farm, which go merrily on to a lake that is sometimes peaceful, sometimes playful, sometimes rough, sometimes dangerous. The brooks run on day by day, and once in a while restless little feet wade in them, the while curious young minds find out some mysterious things that the busy world knows nothing about. Who is willing to live where there is not a brook to ripple gaily along in the sweet spring weather?

And I nearly forgot to tell you about the great rocky cliff within a stone's throw of the gray house. This is the most wonderful place of all. Trees grow on it and about it, and as you sit on the upper edge of it you are among tree-tops and many a shy bird comes close to you, in no way suspicious of your very quiet self. Four or five feet below you on the side of the cliff a phœbe's nest can be seen. What a safe place some little birds choose! Neither you nor I would dare to climb up to it and no one could climb down to it, so there the small home stands in safety on a ledge of the rock-bound height. No wonder that phœbe call in early morning is full of energy and confidence — his home is all right and the rest will come. You must hear a phœbe this spring. Do not mistake the chickadee's plaintive, high " phœbe " call for that of the real

phœbe, whose notes are harsher and lower, more decided and more contented. The phœbe looks much like the pewee, but he has a little trick of pumping his tail up and down when on a telephone wire or a twig, which distinguishes him at once. How the phœbes that I have watched many a day seem a part of the rocky ledge and the still gorge that are near the gray stone house!

Let us imagine that we are all together and about to go into the homelike dwelling that seems to welcome us as we enter. We can sit about the fireplace while we talk of the on-coming spring and all that you will do when the wonder days are really here. Some of the more important things to consider are as follows:

Color.— The changes of color in the landscape — how the hills become more distinct — how the trees show life in every tender twig full of rich color.

Sounds.— Who will hear new notes in the outdoor voices, the chickadee and the sparrow and the rest? Soon the little tree-frog will send its shrill call from the marshes, the crow will caw with spirit, the first robin will sing from the tree, spring will be here. We have loved the winter and have grown strong through its vigorous companionship. We know well its still, white fields, with occasional song of wind and pine and a rare bird note, but the sounds of spring are, perhaps, more welcome.


Horse-chestnut

The burst of spring.— Indeed, the spring may seem to come all at once and there will be so much to do: we shall follow the merry, boisterous winds or the gentle ones; we shall listen to the woodpecker tapping away in the woodlot; we shall smell the new-plowed field; we shall follow the brook and watch the rain and look on while the green things grow.

Trees.— Every boy and girl should watch at least three trees this year. Have in mind the horse-chestnuts, alders, and poplars. A few suggestions that will give you something to think about in connection with these trees will help:

1. How many horse-chestnut trees are there in your neighborhood? Find out by looking for them and by inquiry.
2. What time of year does a horse-chestnut blossom?
3. How many leaflets are there on a horse-chestnut leaf?
4. For what is this tree used?
5. The alders are related to the birch trees. If you can find leaves of

alders and birches, note the difference in the leaves. Notice whether the alders in your neighborhood are large trees or small.

Poplar

6. Watch for catkins on the alders in the springtime.

7. Can you find cones on the trees?

8. Read the following lines written by the great naturalist, Henry D. Thoreau:

"With cheerful heart I would be a sojourner in the wilderness. I should be sure to find there the catkins of the alder. When I read of them in the accounts of northern adventurers by Baffin's Bay or Mackenzie's River, I see how even there, too, I could dwell. They are my little vegetable redeemers. Methinks my virtue will not flag ere they come again." Will you learn these lines and think of them when next you see an alder?

9. How does the poplar that you have heard called the "quaking aspen" get its name? How do the leaves differ in color on the upper and under sides? How does the petiole (stem of the leaf) differ from that of other leaves?

10. How many kinds of poplars have you seen?

Wild flowers.— Besides learning about the trees you will want to find new wild flowers this spring. Some day, perhaps, the teacher will write on the blackboard a list of all the wild flowers that you know. Then in another list she will write some that she knows and that you have never seen. Will it not be interesting to find this year the flowers that are in the teacher's list? Maybe your teacher will take a walk in the woods with you and help in the search. Some flowers know how to hide. Only sharp eyes ever see the wild ginger beneath its satiny leaves.

Alder

If you find any plant that you cannot name, send a specimen to Mr. Tuttle and he will tell you what it is.

Weeds.— Be on the lookout for weeds. If every boy and girl and every man and woman would help in destroying weeds, we should not have so much trouble with them. Do not let weeds go to seed. Learn to recognize the most troublesome kinds.

Learn how to destroy each. This year the boys and girls have for study the following weeds:

1. Purslane, often called "pusley." Cut the plants off with a hoe and remove them from the garden.

2. Bindweed, sometimes called wild morning-glory. Cut off the plants as soon as they appear. Do not drag pieces of the roots from place to place, for they may spread in this way.

3. Pigweed, or redroot. Remove by hand and persistently cultivate and hoe.

Purslane ("pusley")

Gardens.— Every one will make a garden. We wish we might know all about the gardens made by boys and girls in New York State. Perhaps no other piece of work shows the character of a boy or girl quite so clearly as does a garden. The young person who takes the pains to plan his garden carefully; who finds out what kinds of plants will grow well in the soil; who tests his seeds; who weeds and cultivates, and considers the moisture; who persists until harvest time, no matter what discouragements arise; and who finds out what profit has come from his labor — is likely to be worth while. A garden is a telltale; do not give one an opportunity to show your parents and teachers that you are lazy. If you start a garden, make it tell this story: *that you are a worker and will finish what you begin.* You may have hard times fighting weeds and insects and dry weather, but thrifty plants will reward you, and a well-cultivated bit of ground producing something worth while will give you joy that will be worth having.

Bindweed

Suggestions for summer.— This is the last time that we shall talk over things this year and, doubtless, you would like some suggestions for summer work. These you will find on page 1070. Perhaps some older person in the neighborhood will meet with you once a week and help to make your study more interesting. Before school opens in the fall write to Mr. Tuttle and tell him what you have learned during the summer.

Now we must leave the gray stone house and go back to the workaday world. As you go out by the side door you can see at your right a poplar tree. This is well, for you are to study poplars this year. In the illustration on page 1065 you can see how the poplar looked when it was a little tree. Now it is tall and straight and handsome. I am sure you would like to have a tree like this near your own room. In the windy autumn weather, and, indeed, whenever breezes are about, it makes a kind of music that is very strange and wonderful.

SUGGESTIONS FOR SUMMER WORK

1. The study of plant and animal life along a country roadside.

2. The study of a brook and the brookside. All life in and along a brook.

3. What you have learned about bird life. We shall be particularly interested in information obtained on the value of birds to the farmer.

4. What you can learn from personal observation of the animals of field and forest. In this line of observation it would be well for you to consider the field mice, muskrats, squirrels, moles, woodchucks, and any other life that you find. Observe snakes, toads, and salamanders. They are often useful. Can you find out in what ways? Try to get over your fear of harmless snakes. Study their habits.

5. The history of one tree from May 20 to October 1. The kind of tree; where it stands; when it blossoms; the kind of fruit that it bears; the insect and bird life in connection with the tree; whether or not it makes a good shade tree; how long it has stood in the place where you found it; whether you think you can tell it when it has no leaves. How?

6. The story of your garden. Where it is located; when you planted it; how you planted; what you planted. Write about the care of the garden; the pests that annoyed you most; the weeds that were most troublesome; the birds, butterflies, and other forms of life that came to your garden.

7. The history of some plant colony, either in woods, along the wayside, or in a corner of your garden. Give the size of the region that you studied; what plants you found growing there; which plants seemed most thrifty; why you think these plants associated with each other.

8. The study of some insect pest, such as potato beetle, peach borer, tent-caterpillar, mosquito.

9. As much of the life history of a moth or a butterfly as you can study during the summer. The monarch butterfly is interesting. You will find the larva, or caterpillar, on milkweed. If you take the caterpillar home and feed it fresh leaves of the milkweed, it will probably become a chrysalis, and a butterfly will emerge from this chrysalis. You will be able

to give us a very interesting account of it. The caterpillar that afterward becomes a monarch butterfly has a green body, with narrow black and yellow cross-stripes.

10. Perhaps some of you will this summer help to improve the school grounds. If so, tell us about it.

11. What farm crop has been most interesting to you? What can you learn about this crop? How was the ground prepared for it? How was it handled? How harvested?

Measuring beans

GARDENS

THE EDITORS

Many of our boys and girls will have gardens this spring at home or at the school or on a vacant lot in the neighborhood. The success of a garden depends on a wise choice of ground, good preparation of the soil, good seed, good cultivation, and most of all on the character of the young gardener, who must be painstaking, persevering, industrious, and able to continue a piece of work until it is finished.

In the following pages are some directions for garden-making. Read them carefully and talk them over with the man who has the best garden in your neighborhood. Perhaps your teacher will ask him to come to the school and give a talk on garden-making. You will then be able to ask him some questions that are puzzling you in connection with your garden plans.

Seeds are much less expensive if purchased in bulk than in packets, but if you are to have a small garden you may decide to buy some of the seeds from James Vick's Sons. See page 1078. Read the directions carefully. *Your order must be sent through the teacher.*

MAKING A GARDEN

ALBERT E. WILKINSON

Gardening in Camp Lanier

Many boys and girls are not familiar with the principles of vegetable-gardening. We shall therefore present some of the essential factors necessary to success in gardening.

Planning the garden.— Before the actual gardening is begun, a well-drawn plan should be made by each boy and girl. Draw your plan to a scale — that is, let $\frac{1}{4}$ inch on the paper represent 1 foot in the garden. Using this scale on a garden 25 by 50 feet, we shall have a drawing that will be $6\frac{1}{4}$ by $12\frac{1}{2}$ inches.

With this same unit of measure represent the rows as they should be made, always remembering that for each foot in the garden you will use one fourth of an inch on the paper. Consult the table, page 1076, for the space between the rows of vegetables as well as for distances apart of the plants in the rows.

In planning a garden it is very important that vegetables of a tall habit of growth should be so placed that they will not shade the vegetables having a low habit of growth. This will give all the plants some sunlight.

Seeds.— After the plan is drawn on paper the young gardener must decide how much seed will be needed. The planting-table will help in this. It has a list, or column, of the amount of seed required for 100 lineal feet. If the row in the garden is only 50 feet long, the seed required will be one half the amount named in the table. It is always best to order more seed than is actually required.

When the quantity of seed is known it should be ordered from a reliable seed house. Consult a neighbor who has a successful garden.

Testing seed.— Choose ten average seeds of one variety. Provide a box eighteen inches long, twelve inches wide, and at least two inches deep, and fill it with good garden soil. Make shallow lines in the soil one inch apart, of a depth about two to four times the diameter of the seed to be planted; place the ten seeds that you have chosen in the first of these shallow marks, or furrows. Mark the box at the end of the row on the wood, so that you will know the variety of seed that is planted in that row. Choose ten more seeds of another variety and plant them in the second row. Continue in this way until all the varieties of seed bought have ten samples planted in the box. Cover the seed and the rows with soil and press the soil firmly with the palms of your hands. Sprinkle about a pint of water over the soil and place the box near the stove or in a sunny window where it will have a fair amount of heat. Water the soil during the next two weeks. Mark on paper the date of planting the seed, and each day record the number of plants that show above the soil. If at the end of two weeks nine of the ten seeds in row one have shown above ground and are still healthy and green, the percentage of growth will be ninety; if eight, eighty; if six, sixty. If the test shows less than sixty per cent, more seed will have to be used in the actual planting of the garden in order to obtain the number of plants desired.

The above is the most valuable test of seeds, as it shows not only those seeds that will sprout well, but also those that under fair conditions will grow in the garden. Seeds that show a high percentage in this test will be profitable to plant.

Location.— If father or mother will give you your choice of a place for your garden, choose a piece of land that has been under cultivation for two or three years. If this land slopes slightly toward the south and is a loamy, not clayey, soil, it will answer your purpose. If the land is near the hen-yard it will be well to fence the garden or to plan to keep the hens in their yard.

Staking the garden.— With pieces of wood stake out the garden corners on the land to be used. These stakes will serve to show you where to spread manure, or where to plow, spade, or harrow.

Manuring.— If good, well-rotted stable manure is available, spread a generous coating of it on the garden. It is doubtful whether too much can be applied. Some of the best gardeners use as much as three or four inches of well-rotted manure spread over the land.

Plowing or spading.— If the ground is plowed it should be done after the manure is spread, and should be to a depth of six or eight inches. It is better, however, to use a spade or a spading fork. Such a tool will turn the soil to a greater depth than will the plow, and if employed by a boy who will use his head as well as his hands in his work the manure can be placed at a very good depth.

Smoothing.— Harrowing can follow the plowing, and fine smoothing can be done after that. If horse power is not used the hand rake will be the most serviceable tool. The rake can be used for breaking all lumps, as well as for leaving the soil level and smooth.

Permanent staking.— After raking, permanent stakes can be driven at the corners of the garden in place of the temporary stakes first used. A nail should be driven in the top of the southeast corner stake and exact measurements from this stake to the other stakes should be made, placing nails in the tops of the other stakes where they are found by measurement to be needed. The use of these nails will help greatly in future exact measurements for planting.

Planting.— The time for planting as given in the planting-table must be used with common sense and varied to suit the conditions of weather and other local factors of the great outdoors. It is intended to serve merely as a guide. The young gardener should ask advice of the most successful grower of vegetables in his neighborhood.

In planting seed the rows in the garden should correspond to the rows as planned on the paper. Measurements from the nearest stakes at both ends of the rows should be taken. A garden line or some other means should be used for keeping the rows straight.

The table given on page 1076 will serve as a guide in planting the seed, but no one can be taught gardening from a printed page. Consult your parents, your teacher, your district superintendent, and any successful gardener. Good advice at first hand will be valuable.

A furrow should be opened to the required depth with a hoe, which, as above said, should be guided by a line, or mark. The seed should be spread along the bottom of this furrow, then dirt should be filled in over the seed and pressed down by walking on it.

If there is a planting machine on the farm, such as a Planet Jr., Iron Age, Columbia, or the like, it may be used for planting.

Transplanting.— If tomatoes or other plants are raised in a hotbed, cold-frame, or seed bed, they should be removed with the largest amount of root surface possible and placed in the garden in the straight row planned for them, at the proper distance apart, in the following manner: With a trowel dig a hole larger than the plant roots need; fine the earth; set the roots of the plant slightly deeper in this fine earth than they grew; cover them with dirt; press hard; fill in more dirt, pressing now and then, until the level of the soil is reached. The plant will then be transplanted in such a way that it will have the best opportunity to grow.

Thinning.— If the plants come up too thickly they should be thinned according to directions given in the table under the heading "Distance apart of plants in row." This is necessary in order to give the remaining plants the space that they require for the best growth.

Cultivating.— There are two things necessary for good cultivation— keep them in mind: first, absence of weeds; second, the surface soil should be loose at all times. This can easily be done with the hand, the hoe, and the rake. Pull out the weeds, hoe around the plants, rake after hoeing.

Watering.— If the season is exceptionally dry, water may be necessary for success in obtaining good growth. The hose, watering-can, or pails can be used. However, good culture from the beginning is the most important factor in maintaining the water supply.

Insects and diseases.— Insects can be controlled somewhat by hand-picking. Diseases may be controlled by keeping the plants in a thrifty, continuously growing condition, by giving good culture, by watering, and by adding manure dissolved in water much diluted.

PLANTING TABLE FOR VEGETABLES

Kind of vegetable	Seeds required for 100 feet of row	Distance apart of rows (hand cultivation)	Distance apart of plants in row	Depth to plant seed	Time to plant in open ground
Beans, bush, green	1 pt.	18 in.	5 to 8 plants per ft.	¾ in.	May to July
Beans, bush, wax	1 pt.	18 in.	5 to 8 plants per ft.	¾ in.	May to July
Beets	2 oz.	12 to 15 in.	5 to 6 plants per ft.	½ to ¾ in.	April to August
Cabbage, late	¼ oz.	24 in.	24 in.	½ in.	May to June
Carrots	1 oz.	12 in.	6 to 7 plants per ft.	½ in.	May to June
Corn, sweet	¼ pt.	30 in.	Hills, 24 in.	1 in.	May to June
Cucumbers	½ oz.	4 ft.	Hills, 4 ft.	1 in.	May to July
Lettuce	½ oz.	12 to 15 in.	10 to 12 in.	½ in.	April to September
Onion seed	1 oz.	12 in.	4 to 5 plants per ft.	½ to ¾ in.	April to May
Onion sets	1 qt.	12 in.	4 to 5 plants per ft.	1 to 1½ in.	April to May
Parsnips	½ oz.	15 to 18 in.	5 to 6 plants per ft.	½ to ¾ in.	April to May
Peppers	⅛ oz.	18 in.	15 in.	½ in.	May to June
Pumpkins	½ oz.	8 ft.	Hills, 10 ft.	1 in.	May to July
Radishes	1 oz.	12 in.	10 to 12 plants per ft.	½ in.	March to September
Spinach	1 oz.	12 in.	6 to 7 plants per ft.	1 in.	Early in spring or in August
Squash, bush	½ oz.	3 ft.	Hills, 3 ft.	1 in.	April to June
Squash, late	½ oz.	8 ft.	Hills, 8 ft.	1 in.	April to June
Tomatoes	⅛ oz.	3 ft.	3 ft.	½ to ¾ in.	May to June
Turnips, early	½ oz.	18 in.	6 to 7 plants per ft.	¼ to ½ in.	April or July
Turnips, rutabaga	¼ oz.	18 in.	3 to 4 plants per ft.	½ to ¾ in.	May to June
Watermelons	1 oz.	8 ft.	Hills, 8 ft.	1 in.	May to June

PLANTING TABLE FOR FLOWERS

Variety	Amount of seed for 10 feet of row	Depth to plant seed	Distance apart of rows	Distance apart of plants in row	Time to plant		Height of plant when well grown	Color of flowers
					Indoors	In open ground		
Ageratum	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	March.	May	6 to 9 in.	Blue
Alyssum	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	....	May	3 to 6 in.	White
Aster	1 pkg.	$\frac{1}{2}$ to $\frac{3}{4}$ in.	12 in.	9 to 12 in.	March.	May	12 to 36 in.	White
Balsam	1 pkg.	$\frac{1}{2}$ to $\frac{3}{4}$ in.	24 in.	24 in.	April	May	24 to 30 in.	Pink
Candytuft	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	4 to 6 in.	April	May	6 to 10 in.	White
Cockscomb, low	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	18 in.	12 in.	April	May	12 to 18 in.	Red
Cockscomb, tall	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	24 in.	24 in.	April	May	36 in.	Red
Larkspur, annual	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	12 in.	March.	May	12 to 18 in.	Blue
Marigold	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	April	May	6 to 24 in.	Yellow
Mignonette	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	12 in.	March.	May	12 to 18 in.	Greenish yellow
Nasturtium	1 pkg.	$\frac{1}{2}$ to $\frac{3}{4}$ in.	12 in.	12 in.	....	May	9 to 12 in.	Red, orange
Pansy	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	March.	April	4 in.	Various
Phlox	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	18 in.	12 in.	March.	May	12 in.	Red
Salvia	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	24 in.	18 in.	March.	May	24 to 36 in.	Scarlet
Snapdragon	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	12 in.	March.	May	12 to 36 in.	Yellow
Stock	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	18 in.	12 in.	March.	May	12 to 18 in.	Scarlet
Sweet William	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	6 in.	March.	June	18 to 24 in.	Pink
Verbena	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	18 in.	18 in.	March.	May	6 to 8 in.	Blue
Zinnia	1 pkg.	$\frac{1}{4}$ to $\frac{1}{2}$ in.	12 in.	12 in.	April	May	12 to 24 in.	Red

BUYING SEEDS

FOR the cultivation of a large piece of ground for children's gardens, it would be well to buy the seeds in bulk. Some of the older children will enjoy putting them up in packets and marking them. This will be a good school exercise. The teacher, with some of the children, might estimate the number of lineal feet to be planted with each kind of seed. If the teacher does not know the quantity needed for this estimate, the seedsman will tell her. If there are but few children in the school or a small piece of ground to be cultivated, the penny packets will be found satisfactory.

All orders must be sent through the teacher.

Post office.. *State*..

School No.. *Grade*..

Teacher..

JAMES VICK'S SONS
189 Main Street, East 18–20 Stone Street
Rochester, N. Y.

Please fill our order for the following:

Flower seeds

..................Aster
..................Alyssum
..................Bachelor's-button
..................Calliopsis
..................Candytuft
..................Dianthus
..................Marigold
..................Mignonette
..................Morning-glory
..................Nasturtium { dwarf or climbing
..................Petunia
..................Phlox
..................Poppy
..................Scabiosa
..................Sweet pea
..................Zinnia

Vegetable seeds

..................Beans
..................Beets
..................Carrots
..................Lettuce
..................Onions
..................Radishes
..................Spinach
..................Sweet corn

Postage, two cents extra for every 12 packets of flower seed, and three cents extra for every 12 packets of vegetable seed. Large orders will go cheaper by express, charges to be paid by the purchaser. No order accepted for less than one dozen packets.

FRUITS FOR THE HOME GARDEN

H. B. Knapp

There is nothing that adds more to the beauty of a country home or affords more real satisfaction and enjoyment to its possessor, than does a well-kept garden with its fruit, flowers, and vegetables.

Aside from the pleasure that the garden affords, it may be made a constant source of income by supplying fruits and vegetables for the table almost the year round. It is not too much to say that the garden can be made the most profitable area on the farm.

The vegetables that are most desirable for the home garden are known to all, but the selection of the proper fruit varieties for home use has been given little attention. We should first, however, decide on a suitable location for our garden.

While the various fruits differ somewhat in their soil adaptations, they are cosmopolitan enough to succeed on the same soil type, provided it is rich, well-drained, and retentive of moisture. Probably the most acceptable type would be a light, friable clay loam, perhaps grading into a gravelly loam, which is so favorable for the peach. The garden should be so located that air currents pass readily to and fro across the field, or, as it is stated, the air drainage must be good. This is in order to lessen the liability to the development of fungous diseases, and also to avoid as far as possible the danger of frosts at blossoming time.

In choosing the different kinds and varieties of fruits, we wish first of all to choose them so that we may have a continuous supply of fruit in its season, from the time when the strawberry ripens in June until the apples are gathered for the winter. In order to do this we must plant a greater number of varieties than we would for a commercial purpose.

Quality holds a high place in the choice of varieties for home use, for we all prefer to have the finest and best for ourselves. We cannot, however, sacrifice the characters of great vigor and hardiness even to quality. The varieties must be disease-, drought-, and cold-resistant, for they will seldom be grown under ideal conditions. They should be pruned and cultivated, if possible, for few of them will be sprayed or nurtured as are many of our commercial varieties.

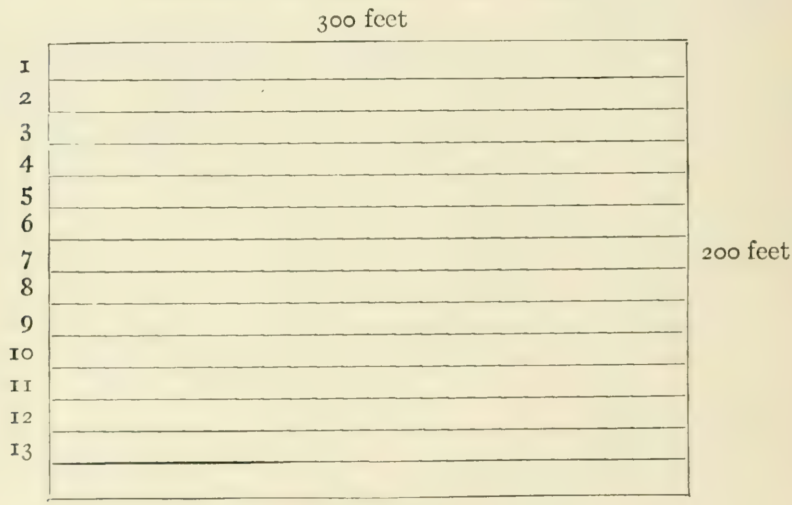
Considerable care should be taken in choosing the varieties themselves. In most cases it is better to consult with men who are growing the fruits successfully in your locality and under your conditions, than to depend on publications.

The care of the garden may be greatly facilitated if a little thought is given to the planting plans with an eye to future developments. The garden should be so chosen that the rows can be long — the fewer bouts and turns, the better. The rows should be far enough apart so as to

admit of horse cultivation. Horse labor is cheaper than man labor, and the garden will be much better cared for with a plow and cultivator than it will be with a spade and hoe.

Plant fruit trees together, bush fruits together, and vines together. Beware of over-intensive farming here, also. As a rule it will be best to use no fillers. The ground between the tree rows can be cropped with potatoes, beans, and similar crops until the trees need the space. Do not plant rows of short-lived fruits not intended for fillers between rows of long-lived fruits. The former should be so placed that they can be removed without interfering with the general plan of the garden. The accompanying plan may serve as a guide in a general way:

PLANTING PLAN FOR THE HOME GARDEN



Distances

1. Apples	40 by 40 ft.
2. Pears	25 by 25 ft.
3. Quinces	16 by 16 ft.
4. Plums	20 by 20 ft.
5. Cherries	Sour, 20 by 20 ft.; sweet, 35 by 35 ft.
6. Peaches	20 by 20 ft.
7. Grapes	8 by 8 ft.
8. Currants and gooseberries	4 by 6 ft.
9. Blackberries	4 by 6 ft.
10. Black raspberries	4 by 4 ft.
11. Red raspberries	4 by 5 ft.
12. Purple-cane raspberries	4 by 5 ft.
13. Strawberries	18 in. by $3\frac{1}{2}$ ft.

More than one row of some fruits may be desired, depending on the size and shape of the garden and on the tastes of the farmer; therefore, in the table the approximate distances each way for planting are also given.

Following is a list of varieties from which selections for the home garden may be made. Whenever possible they are arranged in order of season of ripening, both as to kinds of fruits and as to varieties. In choosing varieties of strawberries, note should always be made as to whether they are perfect or imperfect, as listed in catalogues. If imperfect, more than one variety should be set in the same patch.

Strawberries

Michel's Early
Bederwood
Glen Mary
Sample
Gandy
Marshall
Senator Dunlap
Stevens' Late Champion

Red Raspberries

Marlboro
Cuthbert
June
Loudon
Herbert
Columbian } Purple
Shaffer } Purple

Black Raspberries

Gregg
Cumberland
Black Diamond
Kansas
Plum Farmer

Currants

Red

Fay
Cherry
Red Cross
Wilder
Victoria
Pomona

Currants

White

White Grape

Black

Black Naples
Black Champion

Gooseberries

Pearl
Downing
Houghton

Blackberries

Early King
Agawam
Rathbun
Snyder
Mersereau
Blowers
Kittatinny
Eldorado

Grapes

Winchell (Green Mountain)
Moore Early
Brighton
Worden
Delaware
Niagara
Concord
Catawba
Isabella

Cherries

Sweet

Black Tartarian } Black
Windsor }
Governor Wood
Napoleon
Yellow Spanish

Sour

Early Richmond
Montmorency
English Morello

Apples

Early

Red Astrachan
Early Harvest
Yellow Transparent
Primate
Sweet Bough

Late Summer and Fall

Gravenstein
Fall Pippin
Wealthy
Dyer

Late Fall and Winter

Hubbardston
Tompkins King (top-worked)
Wagener
Fameuse (Snow)
McIntosh
Twenty Ounce
Northern Spy
Rhode Island
Baldwin
Red Canada
Rambo
Pound Sweet
Tolman (Sweet)
Roxbury

Apples

Crab

Transcendent
Hyslop

Pears

Elizabeth
Giffard
Clapp Favorite
Bartlett
Seckel
Anjou
Bosc
Sheldon
Winter Nelis
Josephine

Plums

Abundance
Reine Claude
Fellenberg
Bradshaw
Lombard
Shropshire (Damson)
Wickson

Peaches

Greensboro
Carman
Rivers
Triumph
Early Crawford
Fitzgerald
Elberta
Late Crawford
Crosby
Foster
Stevens Rareripe
Salway
Smock

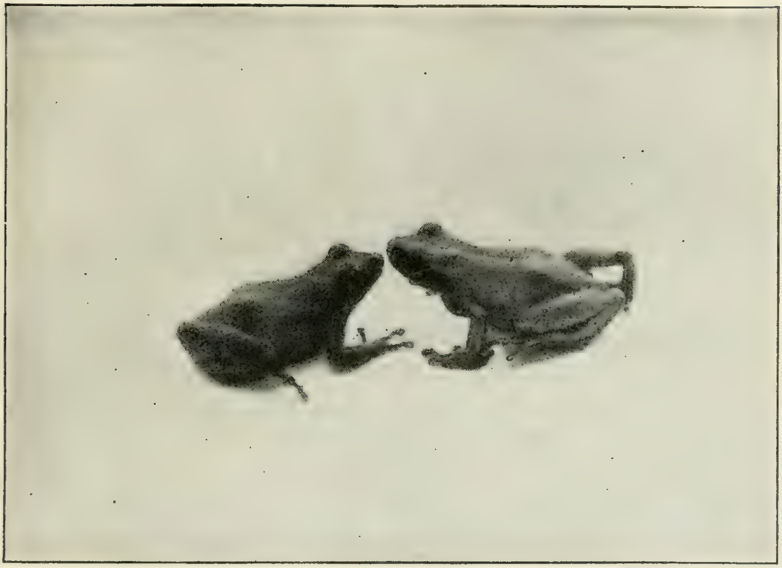
Quinces

Orange
Rea

THE PEEPER

(HYLA PICKERINGII)

A. A. ALLEN



Peepers

Throughout the country and suburban districts, perhaps no sound of nature attracts more general notice than the early spring chorus of the Peepers. Hundreds of shrill voices demand our attention and cry out that spring has come. Every ditch and every pool resounds. True, the majority of persons have never seen a Peeper and would not recognize it if they did, but the calls of the Peeper can never be forgotten.

Nor is it a wonder that most persons live in ignorance of the author of the wonderful notes. Hidden away amongst the vegetation at the edge of the pond, even though his throat be swollen until it is many times larger than his head, he is practically invisible. As long as we remain disinterested, he and his fellows make the air quiver. But let us approach and immediately they are silent and no amount of searching will find them. All have buried themselves in the mud, and the deafening chorus gives way to silence. Patient watching may reward us, however, so that finally, after what seems an endless wait, one small voice starts up from the farthest corner of the pond. Weak at first, but gaining in strength as one by one he is joined by his brothers in other parts of the pond, it is not long before the air again reverberates. At first we may be confused by the great number of voices, but soon we single out a

voice that seems almost at our feet and we move very slowly and carefully lest a false step startle him and cause us to repeat our former wait. After diligent searching without reward, the voice crying "peep-peep," before our very noses, we are about to give up in despair when a slight movement betrays his whereabouts. There he is, in plain sight amid the grass stems. We wonder that we did not see him before. His throat blown out to the size of a marble and almost entirely concealing his small head, he looks more like a bubble than a living thing. Furthermore, his piercing cry is so deceptive that it is no wonder we did not find him sooner.

If we are deft with our hands or with a net, we may catch him, otherwise another long wait will ensue. If successful a surprise awaits us. For out of all proportion to the size of his voice, the creature that we have captured is scarcely an inch long and smaller than the end of a finger. Let us take him to the schoolroom, for we will find him a most interesting pet.

Never growing over an inch in length, the Peeper is one of the smaller of several species of tree-frogs found in New York State. These tree-frogs may be distinguished as a group from the true toads and frogs by the presence of small viscid disks, or pads, on the ends of the toes. In some species these disks are very small, but in the Peeper they are fairly conspicuous. The Peeper is furthermore readily distinguished by the dark bar between the eyes and by the oblique cross on the back. The general color varies considerably, from a dark grayish brown when in the sunlight to a light fawn when the Peeper has been for some time in the shade. The change in color often takes place rather rapidly, as can be demonstrated by removing him from a dark, cool box to the bright, warm sunlight. The markings that were prominent while the general color was light now become very inconspicuous. Unlike his larger brother, the common tree-toad (*Hyla versicolor*), the Peeper never changes to green, although in the fall the color often takes on a decided orange cast.

The Peeper is not a strictly aquatic animal, for it is only during the breeding season that he lives in the water. Passing the winter beneath a log, stone, or pile of rubbish, the first few warm days of spring thaw him out and he starts for the ponds. Very often, indeed, we hear his shrill note from the bed in which he has passed the winter, long before he reaches the water.

The males reach the ponds first, the chorus having attained considerable volume before the appearance of the females. The females are more difficult to find than are the males, for they lack the vocal ability. They can be easily distinguished by the absence of the vocal sac, which is evident on the throat of the male, even when not distended, as dark, wrinkled skin. Soon the eggs are laid; but they are seldom seen, for, instead of being deposited in bunches or strings as is the case with frogs and toads,

they are laid singly or in groups and concealed by vegetation. After the eggs have been deposited, the parents have no further care for them and soon leave the water for the rest of the year. The eggs develop into small tadpoles similarly to those of the common toad, and these transform into the adult stage mostly during July.

During summer and fall, the adult Peepers spend their time in the grass and among the leaves of the forest floor in search of small insects, snails, and the like, which constitute their food. At this time they are inconspicuous and seldom found. Oftentimes they get up into the trees, for they are good climbers; and it is this fact that gives them the name of "tree-frog." In the fall we may often hear single individuals calling from some weed or bush where they have perched, but the spring chorus is not resumed. With the approach of cold weather the Peepers crawl under a log or into some out-of-the-way place to pass the winter. Every warm day before the appearance of snow brings them out, however, and far into November we may hear their shrill notes.

Suggestions:

1. The single note of a Peeper is a high, shrill, sharp whistle, varying in pitch with individuals and only occasionally tremulous. The individual notes are lost, however, in the chorus, which simulates a continuous refrain with a degree of rhythm. If there is a pond anywhere in the neighborhood, this chorus may often be heard from the open schoolroom window. If not, an excursion to a near-by pond should be made shortly after the ice has disappeared.

2. The Peeper should be kept in a glass jar covered with a screen or cheesecloth and having water or moist soil or moss in the bottom. He will probably not remain in the water, but will climb up on the sides of the jar, when the viscid disks on the toes can be easily studied. Note the number of fingers and toes, and the size of the disks on each. Note the purpose and manner of using these disks. Notice the webbing of the toes. How extensive is it and how does it compare with that of a frog or a toad?

3. Study the vocal sac. Note its position and appearance when not distended. If several Peepers are kept together they are more likely to call, but even single individuals call at times. Note the size and shape of the vocal sac at the time when the note is given. The sound is produced by the vocal chords, but it would be very weak were it not intensified by the vibration of air in the vocal sac, which serves as a sounding-board or a resonance box.

4. Study the skin. Is it dry, like that of the toad, or moist, like that of the frog? Is it smooth or rough? What is the purpose of keeping the skin moist? The skin in many amphibians serves as an accessory breath-

ing organ, passage of oxygen into the blood taking place through the skin as well as through the lungs. Such forms should always be kept moist because the exchange of gases cannot take place if the skin becomes dry. For the same reason prolonged handling will kill most amphibians.

5. Study the color of the Peeper. Is it always the same? Keep the Peeper in a cool, dark place for some time and then bring him into the bright sunlight. Does any change take place, and how long does it require? What is the purpose of this change?

6. Catch some flies or other small insects and put them into the jar alive. Try to learn how the Peeper catches his food. He may not eat until after you have had him for some time.

7. In order to study the development from the egg it will be much easier to select some other species. The common toad is most satisfactory, because the eggs are least difficult to find and the shortest time is required for completing the process.

8. If not already familiar with the notes of the Peeper, one will learn them most easily early in the season before the appearance of the other amphibians. The Peepers appear in March, soon after the disappearance of ice from the ponds. If what has been said concerning the notes be borne in mind, one should have no difficulty in recognizing them. The notes of all the frogs are low and guttural; those of the toads are shrill and high, but continuous trills. In the western parts of the State another tree-frog, the swamp cricket frog (*Chorophilus triseriatus*) is also abundant and resembles the Peeper somewhat closely. It can be easily distinguished by the absence of the oblique cross on the back and by the small size of the viscid disks. The note of the swamp cricket frog, although similar to that of the Peeper, differs in that the individual notes, although short, are always tremulous, while those of the Peeper are sharp and entirely free from this quality.

9. Note the temperature of its body and see whether there is a change after the Peeper has been for some time in the sunlight. Amphibians, as well as reptiles and fish, are known as "cold-blooded" animals. Their blood is not, however, always colder than that of the higher animals. The chief difference is that "warm-blooded" animals have a constant temperature and "cold-blooded" animals have a temperature that varies with that of the environment.

Note. — In speaking of peepers that he found, Thoreau says: "I keep them in a tumbler. Peep at twilight and evening, occasionally at other times. One that got out in the evening onto the carpet was found soon after by his peeping on the piano. They easily ascend the glass of the window; jump eighteen inches and more; * * * will sit half a day on the side of a smooth tumbler; make that thrilling note in the house; remain many hours at the bottom of the water in the tumbler, or sit as long on the leaves above."

JOHN WALTON SPENCER

On October 24 Mr. John Walton Spencer finished his work in this world. His efforts on behalf of the boys and girls of New York State will not be forgotten. We believe that all teachers and school children who knew "Uncle John" either personally or through his gifted power in correspondence will often recall him through the years to come. The passing of one who found a way into the hearts of little children is a great loss to the world. Fortunate indeed are all who received inspiration from "Uncle John" during his life of service.

LETTERS FROM GIRLS AND BOYS

District 14; Town of Danby; Tompkins county

Brookton, N. Y., January 15, 1913

Dear Mr. Tuttle:

It will be a great pleasure to tell you about the destroying of the tent-caterpillars.

In the fall of the year, when it is just beginning to get cool, the moth of the tent-caterpillar lays her eggs around the little branches of nearly all kinds of trees, but mostly apple and cherry trees. She sticks the eggs together with a waterproof substance, and the next spring they hatch out, every egg a caterpillar. So there are hundreds of caterpillars in one nest. Mr. Loomis, our teacher, showed us a nest and told us about the damage the caterpillars do. There are seven pupils in the school, and altogether we have gathered one thousand forty-five. I have gathered four hundred and twenty-six of that number. We will gather a lot more, early next spring.

It is not a hard thing to do, and it not only helps to save the trees from this pest, but increases the fruit crop, for many trees are very badly injured by these tent-caterpillars. We all look forward for the March leaflets, for we all like to read them. I think they help any one along the line of nature-study a lot.

Robert J. Griffen

Editors' note.— We are greatly interested in the work that Robert and his schoolmates are doing. This is a suggestion that other rural schools can adopt. Ask your teacher to read the article on apple-tree tent-caterpillars in the September leaflet. Learn carefully the life history of this insect pest. You will find there are two stages that may be destroyed: 1. The egg cluster before the eggs hatch. These clusters are very carefully concealed and it will require sharp eyes in order to find them. 2. The web, or nest, of the young caterpillars. Observe that these nests should be destroyed on dark, cloudy days or at night. On bright days the caterpillars leave the nest in order to search for food. In your work of destroying these insects be very careful not to injure the trees. If the tent-caterpillar is very abundant in your neighborhood, consider the question of removing unnecessary breeding-places, such as hedges of wild cherry trees and the like. One school is doing good work, as you will see from the letter above. In a later letter from Clara Dukoff, a member of a school of twenty-five pupils in Mountaindale, Sullivan county, we find the following paragraph: "We are now trying to collect as many of those tent-caterpillars' eggs as we can, and our teacher offers a prize to the pupil who picks the most. I don't believe that we are collecting them just for the prize but we are doing it to rid this part of the country of this pest. If all the girls and boys of all the country schools would do the same, I believe we would soon get rid of them. We have collected

about seven thousand egg masses. One day my teacher opened a good-sized egg mass and we tried to count as best we could the little eggs that were in it and there were two hundred and seventy-one eggs in the mass." We hope to hear of many schools that are fighting the tent-caterpillar or some other serious insect pest.

District No. 3; Town of Canaan; Columbia county

Canaan, N. Y., January 6, 1913

Dear Mr. Tuttle:

In this letter, I'm going to tell you about how I won first prize on my corn.

Mr. Oliver Kipp, head gardener for the "Berkshire Industrial Farm," held a contest in which all boys and girls under sixteen years of age living in the town of Canaan could enter. This I thought was a good chance for me to show my knowledge in agriculture. So I entered with much enthusiasm, as everything was convenient.

The first thing I did was to select my land, and of course, this year being very dry, I selected very moist ground. Then I put sufficient fertilizer on it and next plowed and harrowed it carefully. I marked it by hand so my rows would be extra straight, but before doing this I picked off all the large stones to make it smooth. After this had been done, I selected my corn, taking the best pint from a peck of good selected seed. The kind planted was twelve rows early Dutton. I used just one pint in planting one tenth of an acre. After my corn appeared above the ground, I took good care of it, hoeing and cultivating till it was ready to cut. I cut, shocked, and husked it all myself. My yield was pretty good, receiving thirteen bushels from one tenth acre. I sorted it out, picked out the best bushel, and took it to the judge, who said it was very nice corn for this year. I received five dollars which was given as first prize, for the best twelve ears of corn. Besides doing all the work I had to keep an accurate account of all work done and seed used. Besides this I had to tell how much fertilizer was used.

I thank you very much for the leaflets you have been sending me. I intend to write many more letters to you, so I can get a picture.

Yours truly,

Elizabeth Haussener

Editors' note.— The letter from Elizabeth Haussener brings up the subject of agricultural contests of various kinds, and it is well that the boys and girls of the State should know what is being done in this line. Last year several contests were held in different places and considerable interest was shown. During the coming summer many of the district superintendents are planning to hold contests of one sort or another. The State College has prepared a special leaflet in order to help those who enter these contests. As soon as a contest is organized we shall send copies of the leaflet to the district superintendents, who will distribute them to the boys and girls competing. We wish to urge you to enter a

contest, if one is held in your district. It will give you a new interest, you will learn much about the thing that you are growing or making, and you will take pride in your exhibit. Do not set out to win a prize, but determine to do your very best work and the prize will come if the work is worthy of it. We hope to see, within a few years, many thousands of boys and girls spending a part of their vacation in contest work. It will give you a clean, wholesome occupation and a spirit of honest competition. Ask your district superintendent about contests when he visits your school again.

A POTATO QUESTION

Editors' note.— In the January leaflet we asked six questions on the potato. Many girls and boys have written to Mr. Tuttle answering these questions. They are usually answered correctly with the exception of the sixth question, which asks: "To what does the 'eyebrow' correspond?" If you will place a potato on the desk, stem end down, you will see that the eyebrow is below the eye in each case. You know that the eye corresponds to the bud of the stem above ground. You know that a bud usually appears in the axil of a leaf. The eyebrow of the potato corresponds, then, to a——?

THE FARMERS' WEEK CORN EXHIBIT

Editors' note.— Farmers' Week is over. The exhibit of corn from rural schools was most successful. There were 440 schools represented, each by a single ear of corn that had been selected at the Corn Day Exhibit held in the school on December 6, 1912. These ears were sent to us by mail, many schools taking advantage of the parcel post. The 440 schools are located in 46 different counties, and the exhibit represented approximately 6,600 girls and boys. The corn was judged by three professors in the College of Agriculture, who selected the best ear of flint and the best ear of dent corn in the exhibit.

The best ear of flint corn was sent by School District No. 7, Town of White Creek, Washington county; Miss Bertha Frisbie, teacher; Mr. F. H. Rich, District Superintendent.

The best ear of dent corn was sent by School District No. 2, Town of Springport, Cayuga county; Miss Margaret E. Melvin, teacher; Mrs. A. M. Kent, District Superintendent.

A prize will be sent to each of these schools.

A full and complete account of the exhibit, together with a list of all the schools represented, will be published in the first leaflet for boys and girls next fall. We hope that every rural school will plan to hold Corn Day on December 5, 1913, and will send us a prize ear of corn for our next Farmers' Week exhibit.

A LETTER TO GIRLS AND BOYS

Near the end of winter

Dear Girls and Boys:

The days are growing longer. The air is growing softer. The streams are full. The buds are swollen. Each day brings new signs of spring. You are eager. You are ready.

After school is out to-day ask your teacher to take a walk to the woods with you, and all along the way keep eyes and ears open for the sights and sounds around you. Learn to know and to understand.

By this time each one of you knows what he or she is going to do this summer. Some are going to have a garden, some are going to raise a field crop, some are going to rear poultry, all are going to be happy and busy. Plan your days. From sunrise to sunset, let each minute count. Remember that play counts as well as work. Boys and girls should have time to play. Play hard, play fair. Play and then work. Work and then play.

This is my last message to you for several months. Between now and next fall I shall write personally to as many as I can in answer to your letters. Read this leaflet carefully. Before next fall, read all this year's

leaflets over. Try to carry out at least one piece of work. We have given on page 1070 a list of things to do this summer.

Arbor Day is coming. Make it a day worth while. Plant a tree carefully so that it will surely grow. Ask some one in your neighborhood, who has set out trees, for his direction and advice. There are three things to do without fail: 1. Prune the roots, making sharp, clean cuts. 2. Be certain that the soil is carefully packed around the roots as you fill the hole. Work it down with your fingers. 3. Prune the top, leaving three or four good branches.

You will find that under the letters from girls and boys I have included two that mention definite pieces of work done. Read these carefully and the notes with them. Such definite work was what I had in mind when in my last letter I asked you to write me fully about things of special interest. It is good for you to know what other girls and boys are doing. It is good for them to know what you are doing. In these days we are all working together more than we used to. In business we speak of this as cooperation. We should each strive for two things in life: first, to develop ourselves so that we are strong, healthy, industrious, honest folk; and second, to learn to live and work side by side with those about us in kindness and in harmony.

There is one very good way in which boys and girls can cooperate and help the school. Some of you have written of sending a school exhibit to the county fair and receiving prize money. For several years the county fairs have been offering prizes for such exhibits. Often there have been no entries, yet there is no reason why your school should not take part in such wholesome competition. Do not go to work with the idea of winning a prize. Work to have the exhibit from your school represent the very best effort of each boy and girl. Every one of you from the youngest to the oldest should contribute. Then your exhibit will be the result of the whole school working together. If your school should receive the prize, you will be glad that you helped to earn it. If not, you will learn why you failed and another year the exhibit from your school will be better because you will have increased ability.

Most boys and girls living in the country know the value of money. When you have money to buy something for the school, do not be in a hurry to spend it. Think carefully, consult the persons best fitted to advise you on any purchase, and then buy the best of its kind. One good picture is worth twenty poor ones and, moreover, will last for many years. A good clock, or vase, or bookcase will give more pleasure than three or four cheaper articles costing a like amount. The best things, however, are not always the most expensive. Suitability to the surroundings, combined with artistic lines and durability of material, are some of the factors that count.

Keep in mind Corn Day next fall. It comes on December 5. Grow your own corn if possible. See the report of this year's Farmers' Week exhibit, on page 1090.

Before I close this letter there is something that I wish to tell you. I have a plan that is coming true, I think. For two years now you and I have known and written to each other. It is time that we went further. I want to meet you, talk with you, tramp the woods and fields with you, work with you, play with you, eat with you, and, perhaps, stay in your house overnight. This cannot come to all at once. For some, at least, it will come soon, I hope. Here is my plan. The first day of next October, if all goes well, I shall leave some central point in the State on foot and walk into the country. In which direction? I do not know, for I have no choice. You girls and boys are everywhere, and I shall not have to walk far without finding some girl or boy who knows me by name. For one whole month I shall walk and be among you, going from place to place as the spirit moves me. Will you be glad to see me? Will you walk with me a way, while we talk of the things that we see? Will you take me to the schoolhouse and let me sit among you? Shall we be good comrades for an hour, for a day, and firm friends afterwards? This is my plan. Will it come true? I want it to. Again in April I shall do the same, and thus spend two months of each year getting acquainted with my young friends. Write me what you think of this.

And now good-by. During the coming months, let us not forget each other. Let us come to love and understand the out-of-doors. Let us grow stronger and better. Let us resolve that through us others shall be made happier, not in any great way, but because we daily live with cheerful face and kind words. Let us take one piece of work and do it well, so that we can look back on it and say, "I'm glad I did that; it was worth the hard work."

Do not hestitate to write to me often, in school or out of school. I am glad to get your letters and will answer whenever I have time.

Your friend,

Edward M. Tuttle

TWO WEATHER LESSONS

WILFORD M. WILSON

THUNDERSTORMS

In New York thunderstorms occur most frequently during the summer months, and more frequently during the afternoon than at other times of the day. Usually they last only from a few minutes to an hour at any one place, because they are moving storms and are carried along by the wind. Most thunderstorms in this part of the world come from the southwest and move toward the northeast. It is seldom that they come from the northeast or the north. This is because they usually develop in that part of a cyclone where the winds are from the southwest. You remember that a cyclone is a very large storm, which frequently covers two or three States at one time. In the southeast quarter of the cyclone the temperature is the highest, the rainfall is the heaviest, and here, where the winds blow from the southwest, thunderstorms usually develop. They often occur near the close of a hot, sultry day, and their approach is usually heralded by the appearance of a heavy bank of dark cumulus clouds piled up on the horizon, which gradually spread over the sky as the storm comes nearer. Although the air remains perfectly still until the storm is near at hand, we can often see the clouds on the face of the storm tossed and tumbled about by the violent storm wind. All at once, direct from the storm comes the rushing squall-wind, stirring up the leaves and raising clouds of dust. It is then time to run for shelter, for in another minute comes the downpour of rain or hail, the sharp flash of the lightning, and the roar of the thunder.

Some persons are very much afraid during a thunderstorm, but there really is very little danger. The only sources of danger are the wind and the lightning. The wind from a thunderstorm is never strong enough to blow over a well-constructed building, but if a person is in the woods it is well to look out for falling branches.

Persons are sometimes killed or injured by lightning, but the number is many times less than the number injured every year in railroad accidents; yet, when we wish to make a trip on the railroad, we scarcely think of the danger. Probably the place where we are safest from lightning during a thunderstorm is in a house, particularly if we keep away from the walls and chimney. It is less dangerous to stand out in the open, even at the risk of getting wet, than to seek shelter under a tree, especially an oak tree, for oak trees are struck by lightning more often than other kinds. Beech trees are seldom struck. The reason for this is not known. If one should seek shelter under a tree, it is best not to stand close to the trunk, because the lightning usually runs down the trunk to the ground when a

tree is struck. Although the noise of the wind, the thunder, the lightning, the darkness of a severe thunderstorm, may seem truly terrifying, the real danger is small, particularly if these few simple rules are observed.

THE RAINBOW COLORS

Have you ever seen a rainbow? Of course you have, and probably you have tried to find the bag of gold that some folk say is buried where the rainbow touches the earth. What is a rainbow? Of what and how is it made? Did you ever see a rainbow when the sun was not shining? Did you ever see one when it was not raining where you were standing, or not far away? If you think a moment, I am sure you will say that you never saw a rainbow except when the sun was shining and it was raining or misting at the same time. So we may say that we are very sure that it takes two things to make a rainbow — sunshine and raindrops.

In a previous lesson we said that sunlight has in it all the colors that you can think of except black, which is not a color at all. If this is true there should be some way to separate, or sort, the different colors in sunlight so that we can see them. Perhaps a rainbow is merely sunlight with the colors sorted so that we can see them, and maybe the raindrops sort the colors so that we can see how beautiful they are. How can we find out whether sunlight and raindrops will make a rainbow?

I will tell you how the great scientist, Sir Isaac Newton, found it out. He made a very small hole in his window-shade so as to let in a little beam of sunlight, and arranged a white screen so that the light fell on its center. He then took a very small globe, or sphere, of glass filled with water and placed it in the beam of sunlight; and there on the white screen, instead of a white spot of sunlight, was a tiny rainbow. The little globe, or sphere, of water sorted the colors in the little beam of sunlight and made the rainbow on the screen. After this, Newton did not doubt that sunlight shining through raindrops makes the rainbow.

Do you know of anything besides raindrops that will sort the colors in sunlight so that we may see them? It would not be easy to find a little glass sphere, or globe, of water, like a raindrop, as Newton did, but a three-cornered bottle filled with water will do as well. A three-sided piece of glass, which is called a prism, will do better and is not so hard to find. Perhaps your teacher has one or knows where you can get one. Then pull down the window-shade, make a little hole in it as Newton did in order to let in a beam of sunlight, and place a sheet of white paper so that the beam of light will fall on the paper. Next, place the prism in the beam of light, and you will see all the colors of the rainbow displayed in their order. They will not be in the shape of a bow, because it takes a sphere, or globe, to cast the colors as we see them in the rainbow.

Now, how does a little three-sided piece of glass sort the different colors in a beam of sunlight? You remember the light comes to us from the sun in little waves, or ripples. The finest waves that we can see are violet and the coarsest are red. When a beam of sunlight passes through a glass prism it is bent, or, as scientific folk say, refracted. The violet waves are bent more than any of the others, so they all fall at one place on the screen. The red waves are bent less than any of the others, so they fall at another place on the screen. The green rays are bent just twice as much as the red and half as much as the violet, so they fall just halfway between the violet and the red. The yellow and the orange appear between the green and the red on one side, and the peacock and the blue appear between the green and the violet on the other. When the colors in sunlight are sorted in this way so that we can see them, we have what is called a spectrum.

Arbor Day. Ready for work

ROBIN

Cornell Rural School Leaflet

FOR TEACHERS

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SUBJECT-MATTER

IN

NATURE-STUDY

AND

ELEMENTARY AGRICULTURE

FOR 1913-1914

AS OUTLINED IN THE

NEW YORK STATE SYLLABUS

FOR

ELEMENTARY SCHOOLS

ACKNOWLEDGMENTS

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Through the courtesy of Small, Maynard & Co. we are able to publish the photograph of John James Audubon, page 1246.

By permission of Doubleday, Page & Co. we publish the verses entitled "Gramp," page 1264.

To Harper & Bros. we are indebted for permission to publish the poem "The Enchantment," by Sara King (copyrighted in 1912), page 1099.

THE ENCHANTMENT

Sara King

I wonder how the robin's throat
Hath caught the rain's sweet dripping note,
That little falling, pelting sound,
Liquidly clear and crystal round,
The very heart-rune of the Spring,
Enchanted of the sky and ground,
That conjures life from everything.

No ancient, age-worn witchery,
No incantation, could set free
The fast-bound dead; yet here each day,
Robin and rain in mystic way
Bring life back greenly; ah, and how
One's very heart and pulse obey
That lure of music! Listen now . . .

PART I

LIST OF SUBJECTS FOR 1913-1914 IN NATURE-STUDY AND ELEMENTARY AGRICULTURE

AS OUTLINED IN THE NEW YORK STATE SYLLABUS

BIRDS

FOR special study, the robin and the hen; to be recognized, any two winter birds and any five of the following: junco, song sparrow, wren, ovenbird, chimney swift, wood thrush, sandpiper, flicker, catbird, guinea fowl.

ANIMALS

For special study, the cow; also the earthworm; to be recognized, any of the following: sheep, weasel, snail, rabbit, deer.

INSECTS

For special study, mosquito or house-fly, and one biting and one sucking insect; to be recognized, any four of the following: wasp, cabbage butterfly, lady beetle, cankerworm, horsefly.

Note: The spider is given for recognition. The ways in which it differs from insects should be learned.

PLANTS

For special study, radish; to be recognized, one of the clovers, one of the grains, one of the grasses, and any six of the following: jack-in-the-pulpit, peach, nasturtium, honeysuckle, vetch, dog's-tooth violet, laurel, crocus, pumpkin, celery, iris, Solomon's seal; also any four of the following weeds: sour dock, ragweed, beggar-ticks, Canada thistle, clotbur.

TREES

For special study, the elm; to be recognized, two kinds of fruit trees, one conifer, and any four of the following: spruce, pine, juniper, plum, apple, walnut, dogwood, maple, sumac, oak, fir, tulip tree.

BIRD STUDY

THE ROBIN

A. A. ALLEN

Icy drifts still fill the shaded fence rows and the chill north wind still speaks of snow and winter. Three times the ice has stilled the noisy frogs, three times the whitened marsh has shown brown by noon, and now by the laws of the sages spring should be here. A peeper chirps in a neighboring pond; a chickadee gives his *phœbe* note; a nuthatch rolls his springtime call; and there in the orchard on topmost branch appears the robin. "Good luck," they say, "to see him first on highest branch." Good luck to see him anywhere! Never so rich am I as after seeing the first robin; then home with the glad tidings. "The robin has come and spring is here!" Watch him as he flies to the sun-warmed spot where perchance an early worm may be found. How brilliant is his chestnut breast, how green the grass, how soft the air! We overlook the stubborn drifts, we forget the icy crystals fringing yonder pond. All is changed and the robin has changed it.

Through the long winter he has been with flocks of his fellows in the sunny southland, feeding on berries of mistletoe and holly, and now he is back once more with an appetite for grubs and worms. Occasionally he passes the winter in our chill northland, if he can find a sheltered spot with berries of cedar, grape, or mountain ash; but generally he leaves us in October for the land of plenty. With the first signs of spring, however, back he flies, the harbinger of all the wealth to come. Were he less common, he would no doubt be thought by all a kingly bird, the pride of the whole thrush family. Let him hide in distant forests and reveal himself to a lucky few only, and there would be no bird that could excel his beauty, dignity, or song. Unfortunately for his reputation, but happily for mankind, he is one of our most abundant birds and is most content about our dooryards. He and Chanticleer announce the day. Cheer up, cheer up, cheerily, cheerily, cheerily, he sings and one wakes with a smile. How much easier to start the day right when this is our morning summons!

The male robins come first in the spring and await the arrival of their mates. Frequently they do not sing for many days or even weeks after arriving, but when the females come in late March or early April they

commence their morning and evening choruses. Unlike many birds, the males and females are frequently alike in coloration, the duller colors of some being due more to age than to sex.

After mating takes place, both birds join in building the nest, which is placed in a crotch on a horizontal limb or on some projecting ledge about our dwellings. Frequently the same nesting site is retained year after year. The nest is a rather bulky affair, but a marvel of symmetry in the plasterer's art. An outer layer of straw, rags, and paper is neatly hollowed and filled with wet mud. Bill, feet, and breast are used until a perfect bowl is formed. This is lined with finer grasses until the home is complete. Three to five blue eggs are laid, which both birds take turns in incubating.

Like the young of all our song birds, the robins when first hatched are naked and blind and it is two weeks before they are fully feathered and able to leave the nest. At this time they differ somewhat in color from their parents, for their breasts are much paler and are covered with large round dark spots. In this plumage they are more like other thrushes and show their family characteristics much more plainly than when fully grown.

After the young birds are able to care for themselves, the parent birds generally start a second brood. It is now that they begin to gain a rather unfortunate reputation because of their fondness for fruit. It has been found, however, that by planting mulberries or some of the native fruits it is often possible to attract the robins from cultivated cherries and berries, and thus protect the fruit in a way that is more satisfactory than by killing the birds. It is doubtless true, however, that in some fruit districts where the natural food supply has been replaced by the much more dependable cultivated fruits, the robins have increased unduly and now do considerable damage; but killing should never be resorted to until competent scientific investigation has been made.

" *Rollicking robin is here again;*
What does he care for the April rain?
Care for it? Glad of it. Doesn't he know
That the April rain carries off the snow,
And coaxes out leaves to shadow his nest,
And washes his pretty red Easter vest,
And makes the juice of the cherry sweet,
For his hungry little robins to eat?
'*Ha! ha! ha!*' *hear the jolly bird laugh,*
'*That isn't the best of the stay by half!*' "

LUCY LARCOM

BIRDS TO BE RECOGNIZED IN 1913-1914*

THE EDITORS

Junco

Junco, "Snowbird."— Size: About the size of an English sparrow. General color: Slate color except for belly, which is white.

Distinctive features: When flying it displays white outer tail feathers. This, with its unstreaked slaty color, will distinguish it.

> "*From out the white and pulsing storm*
> *I hear the snow birds calling;*
> *The sheeted winds stalk o'er the hills,*
> *And fast the snow is falling.*
>
> * * * * * *
>
> "*O cheery bird of winter cold,*
> *I bless thy every feather;*
> *Thy voice brings back dear boyhood days*
> *When we were gay together.*"

JOHN BURROUGHS

* The descriptions of birds were prepared by Dr. A. A. Allen.

Song sparrow, "Ground bird."— Size: About as large as an English sparrow.

General color: Above, brown streaked with darker brown; below, grayish white streaked with brown.

Song sparrow

Distinctive features: The streaks on the breast converge into one large spot in the center of the breast. It is one of the most common of our native sparrows and is always found in the neighborhood of bushes or thickets.

"*There is a bird I know so well,*
It seems as if he must have sung
Beside my crib when I was young;
Before I knew the way to spell
The name of even the smallest bird,
His gentle-joyful song I heard,
Now see if you can tell, my dear,
What bird it is that, every year,
Sings, ' Sweet — sweet — sweet — very merry cheer.'

* * * * * *

"*I like the tune, I like the words;*
They seem so true, so free from art,
So friendly, and so full of heart,
That if but one of all the birds
Could be my comrade everywhere,
My little brother of the air,
This is the one I'd choose, my dear,
Because he'd bless me, every year,
With ' Sweet — sweet — sweet — very merry cheer.' "

HENRY VAN DYKE

Questions and suggestions:

1. How many kinds of sparrows are there? (Children will be interested when they learn that twenty-five are listed by Chapman among the birds of eastern North America.)

2. How many sparrows have been seen by members of the class? (Doubtless this list will include many of the following: chipping, English, field, fox, grasshopper, song, tree, vesper, white-throated, white-crowned, and Savannah sparrows.)

3. What observations can the pupils make during the year on the food of sparrows? (This will give opportunity to call attention to the fact that the bill of a sparrow is fitted for cracking seeds.)

4. In what way are seed-eating birds of value to the farmer?

5. It is said that the English sparrow drives away more valuable birds. What observations on this have been made by boys and girls in your community? Have they seen English sparrows feeding on garden crops and grain? Have they seen them feeding on any of the insect pests? If so, to what extent?

6. A large part of the food of the song sparrow is made up of noxious weed seeds. How many boys and girls know what weed seeds the song sparrows eat? Song sparrows eat insects also. What insects?

7. Boys and girls all know the chipping sparrow, with its chestnut crown and the black line through its eye. This bird is valuable because of the insects and weed seeds that it eats. What can boys and girls learn by observation of the food of this sparrow? It is so friendly that an observer often has opportunity to study its ways.

RELEASE

One day
I went
To the fields to rest.

The sun
Hung low
On the rim of the West.

A sparrow
Chirped
As it dropped to its nest.

And my soul
Had found
The boon of its quest.— *L. H. B.*

House wren, "Jenny wren."— Size: Smaller than the English sparrow.
General color: Brown above, lighter below.

Distinctive features: Its small size, unstreaked brown coloration, and habit of carrying its tail erect will distinguish it from all but the winter wren. The latter is very rare in New York State during the summer, except in the mountains. It is a darker bird than the house wren and is much more terrestrial, dodging like a mouse about logs in the woods.

Remarks: Of all the birds that nest in our dooryards and about our houses, the house wren is the favorite. Its tuneful, bubbling notes make it a welcome resident on our grounds, and we eagerly await its return in spring from its winter home in the South. Its tiny body, about five inches long, is full of energy and it seems to have much spirit and a good bit of temper when occasion demands.

House wrens will build in a bird house. The opening in the house should not be larger than an inch in diameter, thus preventing English sparrows from making use of the nesting place. A cavity in a fence post or a tree, with a place for a perch, will invite wrens. Boxes with openings an inch in diameter should be placed about the farm buildings and the school buildings. This will help to encourage wrens to live where they can take part in the business of the farm year after year. The young birds consume much food that includes many injurious insects. It is a good thing to have farm hands who can eat and do their work at the same time, and who provide rare music for the entire countryside — music that is frolicsome and filled with melody.

House wren

Ovenbird, "Teacher bird."— Size: Slightly larger than the English sparrow.

General color: Above, uniform olive-brown; below, white, streaked with black.

Distinctive features: On top of the head is an orange-brown patch. This, with its general color and habit of walking about on the ground in dry woods, will distinguish it. Its song resembles the words, *Teacher, teacher, teacher*, repeated with increasing rapidity.

Ovenbird

" In the days of spring migrations,
Days when warbler hosts move northward,
To the forests, to the leaf beds,
Comes the tiny oven builder.

* * * * * *

" Hour by hour his voice he raises,
Mingling with the red-eye's snatches,
Answering to the hermit's anthem;
Rising — falling, like a wind breath."

FRANK BOLLES

Chimney swift, "Chimney swallow."— Size: About the size of an English sparrow.

General color: Grayish black or fuscous above and below.

Distinctive features: This bird is seldom seen except when flying, when it appears very much like a swallow but with narrower wings. It can be distinguished from all the swallows by its uniform sooty coloration and its apparently pointed tail. It nests in chimneys.

Chimney swift

"A dainty, delicate swallow feather
Is all that we now in the chimney trace
Of something that days and days together,
With twittering bird notes filled the place.

"Where are you flying now, swallow, swallow?
Where are you walking the spaces blue?
How many little ones follow, follow,
Whose wings to strength in the chimney grew?"

MARY BARBER DODGE

Wood thrush

> " *Where the violet shadows brood*
> *Under cottonwoods and beeches,*
> *Through whose leaves the restless reaches*
> *Of the river glance, I've stood,*
> *While the red-bird and the thrush*
> *Set to song the morning hush.*"

Wood thrush, " Song thrush."— Size: Smaller than a robin.

General color: Above, brown, brighter on the head; below, white, with large round black spots.

Distinctive features: The large round spots scattered over the snowy white underparts will distinguish this bird.

Sandpiper, "Spotted sandpiper," "Tip-up."— Size: Larger than an English sparrow, and with long legs and bill.

General color: Above, brownish gray; below, white, with dark spots.

Distinctive features: This bird is found along creeks and lake shores. Its long legs and bill will distinguish it from all but other species of sandpipers. From these it can be distinguished by its spotted underparts and its habit of teetering.

> "*Across the narrow beach we flit,*
> *One little sandpiper and I,*
> *And fast I gather, bit by bit,*
> *The scattered driftwood bleached and dry.*
> *The wild waves reach their hands for it,*
> *The wild wind raves, the tide runs high,*
> *As up and down the beach we flit,—*
> *One little sandpiper and I.*
>
> CELIA THAXTER

Spotted sandpiper

Catbird.— Size: Smaller than a robin.

General color: Slaty gray above and below, with a black crown and a chestnut patch beneath the tail.

Distinctive features: Its slender build, uniform gray color, and habit of keeping to the thickets will distinguish it.

Catbird

"I have heard you tell a tale
Tender as the nightingale,
Sweeter than the early thrush
Pipes at day-dawn from the bush.

"*Wake once more the liquid strain*
That you poured, like music-rain,
When, last night, in the sweet weather,
You and I were out together.

"*Unto whom two notes are given,*
One of earth, and one of Heaven,
Were it not a shameful tale
That the earth-note should prevail?"

Flicker, or golden-winged woodpecker

Flicker, "Golden-winged woodpecker," "High-hole." — Size: A little larger than a robin.

General color: Dark brown above; light brown below, marked with a black crescent and round black dots. Quill feathers of tail and wings black above, golden yellow below.

Distinctive features: A scarlet crescent across nape of neck; white spot to be seen on the rump when flying; the flicker is our only brown woodpecker.

Remarks: How many kinds of woodpeckers are there in New York State? How many do the boys and girls know when they see them? Why is the downy woodpecker of value to farmers? How many woodpeckers are of value? Which one is not valuable? Why?

"*Ah! golden shaft, 'twas he that laughed*
And lifted up his bill;
'Wick, wick; wick, wick.' 'Wake up, be quick';
The ant is on her hill."

JOHN BURROUGHS

WINTER BIRDS

THE EDITORS

"*The north wind doth blow*
And we shall have snow,
And what will the robin do then, poor thing!
He will fly to the barn
To keep himself warm,
And hide his head under his wing, poor thing!"

This old rhyme, so full of interest for the young and of memories for the old, has a tender note of sympathy for the winter birds. Usually a robin knows how to seek comfort, and departs from most sections of the State long before the north wind blows very much; but there are other birds that brave the wind and the sleet and the snow, and here and there appear in wood or wayside or in our dooryards.

Some day when "the north wind doth blow" there should be a school hour with the winter birds. Teacher and children will enjoy going out of the close room for a few minutes to feel the old north wind as it comes sweeping from the hills and blustering along the highways. The boys and girls will whiff the promise of snow, gladness will fill their young hearts, and a real touch with nature will be possible. The bleak hillsides, the brown fields, the gray skies, the white flakes, have much charm. Perhaps a chickadee, a nuthatch, or a crow will share the hour.

Even if there are no winter birds in sight, it will be worth while to make an effort to see one. After the boys and girls have taken a few deep breaths in the keen air, they will be ready to go back into the schoolroom to discuss the birds that may appear in the months to come. A list of birds that children have seen in winter should be placed on the blackboard. Doubtless many of the following will be mentioned:

Crow	Downy woodpecker
Tree sparrow	Hairy woodpecker
Kinglet	Blue jay
Winter wren	Flicker
Longspur	Nuthatch
Junco	Chickadee
Crossbill	Owl
Red poll	Shrike
Snow bunting	Gull

A few facts that the children know as to color, habits, and the like, in connection with the birds listed might be of interest. Then each of the older boys and girls may be asked to select one of these birds for special study, so that if the bird should come into the neighborhood the class will be able to obtain information quickly from the young investigator. The result will be that each child will know some one winter bird well and this makes the best beginning for bird study. The children will learn to consult reference books and to be on the lookout for verification of the facts obtained by observation. A copy of "Bird Neighbors" will be a source of pleasure and profit in this work. It is published by Doubleday, Page & Co., price $2.

In order to give spirit to the work, the teacher might announce that she is going to be on the watch for the following birds: red-headed woodpecker, downy woodpecker, hairy woodpecker, nuthatch, chickadee, and crow. She might ask the boys and girls to help her in collecting information about these birds. Perhaps a pupil who may have selected one of them for special study will write some of his observations in the notebook that the teacher is preparing for her bird record. When occasion offers, some important facts in connection with the teacher's group of birds for study might be discussed. Following are brief field descriptions that will help:

The red-headed woodpecker is about the size of a robin. He has the long woodpecker bill, a handsome blue-black and white coat, and a brilliant red head. The fore breast and neck are red.

The *downy woodpecker* is a little larger than an English sparrow. Black and white above, white below; white along the middle of the back. The male has a scarlet band on the nape.

The *hairy woodpecker* looks much like the downy, but is much larger — about the size of a robin. His outer tail feathers are entirely white, while those of the downy are barred with black.

The *white-breasted nuthatch* is about the size of an English sparrow. The general color as seen in the field is bluish gray above, with top of head and neck black and with white underparts. This bird is something of an acrobat and can travel upside down as easily as right side up. Sometimes he goes spirally around a great bole.

The *chickadee* is more than an inch smaller than the English sparrow. He is gray in color. His bill is short. He is a bit of feathered energy with the happiest of notes. The chickadee is often seen with woodpeckers and nuthatches. Chapman, in speaking of the woodpeckers, nuthatches, and chickadees, says:

"Few birds are easier to identify. The Woodpecker pecks, the Chickadee calls '*Chickadee*,' while the Nuthatch running up and down the tree trunks assumes attitudes no bird outside his family would think of attempting. His powers of speech are in no wise disturbed by his often inverted position, and he accompanies his erratic clamberings by a conversational twitter or occasionally a loud nasal '*yank, yank*,' which frequently tells us of his presence before we see him."

The children should be taught to find out by observation the different kinds of food that birds seem to like best. In midwinter many schools prepare a Christmas tree for the birds. An evergreen near the school is chosen or, if there is no evergreen near, a few branches may be fastened to the window ledges. On the tree the children place suet or beef fat. Seeds and peanuts may be scattered near. A shelf may be placed for food for the birds. If the food is provided until the birds find it, a number will come frequently and thus give opportunity for study on the school or home grounds.

"From out the white and pulsing storm
I hear the snow-birds calling;
The sheeted winds stalk o'er the hills,
And fast the snow is falling.

"Like children laughing at their play
I hear the birds a-twitter,
What care they that the skies are dim
Or that the cold is bitter?

"On twinkling wings they eddy past
At home amid the drifting,
Or seek the hills and weedy fields
Where fast the snow is sifting."

JOHN BURROUGHS

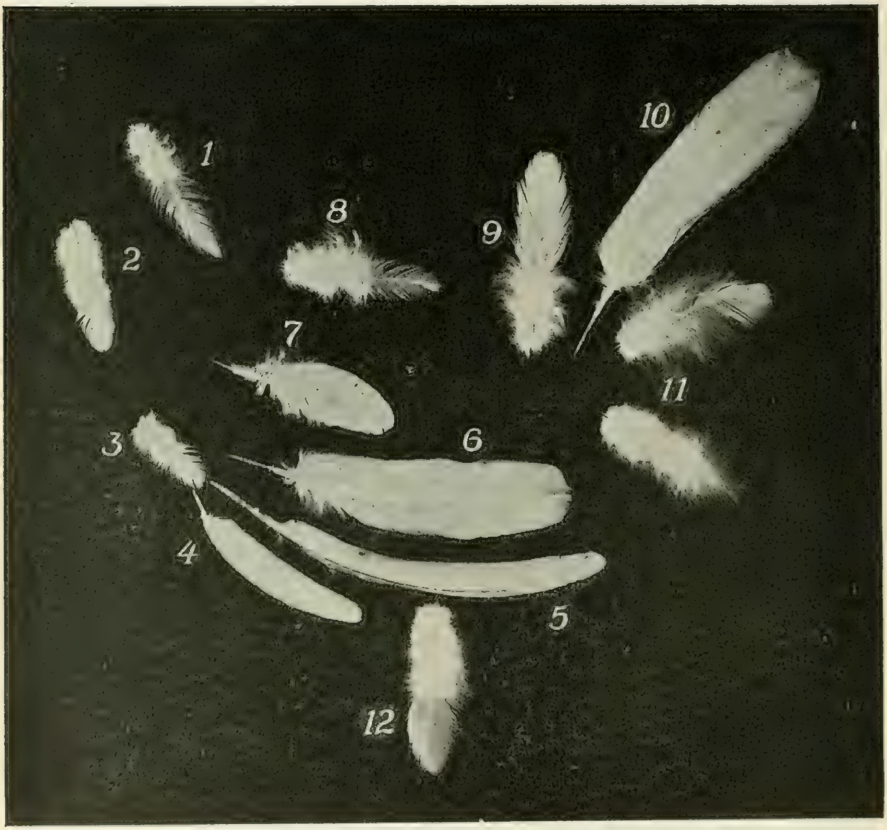
THE HEN

The best way to begin the study of the hen is to have a hen in the schoolroom and to direct the observations of the boys and girls. If interest

Feeding the hen

is maintained, a cock might be brought to school for a day. Some teachers may be sufficiently successful in this work to encourage the boys and girls

to have poultry of different breeds for observation, one bird at a time. This will give opportunity for work that will result in home study of poultry. There is education in lessons of this kind because they give opportunity for accurate observation, and also awaken a new interest in the poultry at home. Many structural features of birds can be taught by means of a hen.



The feathers of a hen, showing their relative size, shape, and position: 1, neck hackle; 2, breast; 3, wing shoulder covert; 4, wing flight covert; 5, wing primary; 6, wing secondary; 7, wing covert; 8, back; 9, cushion; 10, main tail; 11, fluff; 12, thigh

A diagram of a hen may be placed on the blackboard, from which the children may be taught to name the parts that seem important to use in descriptions. The illustration on page 1120 will help in this.

Boys and girls enjoy making collections and they will gain much pleasure and profit from mounting and naming a collection of feathers found in the poultry yard and about the farm. (See illustrations on pages 1118 and 1119.

A collection of eggs as suggested on page 1126 will be of value. This will lead the children to notice eggs as to size, color, texture, and the like.

In the beginning of the lessons the observations should be directed by a few questions placed on the blackboard. The less the children are told

The feathers of a cock, showing their relative size, shape, and position: 1, neck hackle; 2, breast; 3, wing shoulder covert; 4, wing flight covert; 5, wing primary; 6, wing secondary; 7, wing covert; 8, back; 9, tail covert; 10, main tail; 11, fluff; 12, thigh; 13, saddle hackle; 14, sickle; 15, lesser sickle

and the more they find out for themselves, the more successful will be the work. The following suggestions will help:

1. What breed is the hen that you have in the schoolroom?

2. Can the boy who brought her to school give anything of her history? Can he tell how old she is? about how many eggs she has laid in her lifetime? how many chicks she has hatched? What value would it be to the poultry-raiser to be a keen, ready observer of individual hens?

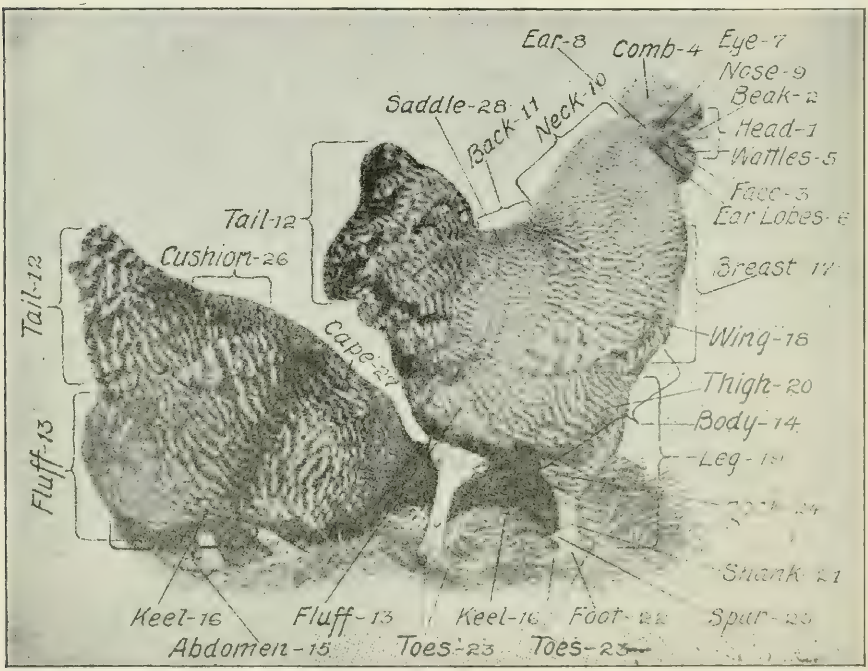
3. Is the hen in the schoolroom healthy? Why do you think so?

4. Have foods brought to school for the hen. What is the value of each kind? What are good food mixtures? (See page 1139.)

5. Why should a henhouse be kept clean and light and have plenty of fresh air? (See page 1138.)

6. How many kinds of feathers can you see on the hen? Note whether some feathers are for use and some for ornament. Who can find a marked difference between the feathers of the wings and those of the tail?

7. The feet and beak will give opportunity for questions; also the position



Parts of a fowl

and color of the eyes, the location of the ears and nostrils, the manner in which the hen eats and drinks.

8. Who is the most successful poultry-raiser in the neighborhood? How many kinds of poultry does he keep? How many birds? How does he house them? Where does he market the poultry? How many eggs did he sell last year? What was the average price per dozen? Will the poultry-raiser give a talk at the school some Friday afternoon?

Note: Last year we published in the September Rural School Leaflet a nature-study lesson on the hen, written by Anna Botsford Comstock. This lesson should be reviewed by the teacher each year.

THE TYPES OF COMBS OF THE DOMESTIC FOWL

James E. Rice

(Illustrations by W. C. Baker)

Method.— The teacher should show the class each of the different types of comb, give its name, point out how it differs from the other types, and give the names of the principal breeds of fowls on which it may be found.

The pupils may be asked to draw on the blackboard or on paper the outline of each of the different types of comb and to write the name of the breed to which it belongs.

The pupils may be taught to recognize the different types of combs by making tracings of the illustrations shown in this lesson. If the best tracings which the pupils make are kept in the school museum, interest will be developed through the spirit of competition.

After the lesson has been learned, an interesting examination may be given to test the pupils' knowledge by asking each to bring a collection of clippings from poultry papers showing the head parts of a large number of breeds of fowls. These should be numbered, the name of the breed removed from the clipping, and a record made of the names of the breeds and the corresponding numbers of the clippings. The clippings should then be thoroughly mixed and the pupils asked to draw out several from the miscellaneous collection. The pupils may be asked to write the number of the clipping, the kind of comb, and the name of the breed of which the head parts are shown on the clipping.

Encourage the members of the class to observe and explain for themselves the differences in size and shape of the comb of the male and that of the female of the same breed. Live fowls should be used for this purpose whenever practicable.

Pupils like to make drawings on the blackboard. One of the types in the leaflet might be copied each day and the characteristics explained to the class by the pupil who makes the drawing.

The different types of combs

The well-recognized types of combs to be found on our domestic fowl are as follows:

1. *The single comb.*— The single comb consists of a single piece of serrated (notched), fleshy growth. It may be large, medium, or small; thick or thin; deeply or lightly serrated; erect or lopped; and may have few or many points or serrations, depending on breed, as shown in Figs. 1, 2, 3, and 4.

The single comb is to be found on the largest number of breeds of fowls, some of which are as follows: Plymouth Rock (Fig. 1), White Leghorn (Fig. 2), White-Faced Black Spanish (Fig. 3), Black Minorca (Fig. 4), Java, Rhode Island Red, Silver Gray and Colored Dorking, Cochin, Langshan, Orpington, and Game.

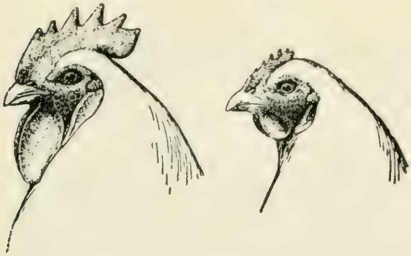


FIG. 1.— *Plymouth Rock*

Single comb, small to medium, five points, finely serrated, erect

Ask the pupils to point out the differences between the single combs shown in Figs. 1, 2, 3, 4; to count the number of serrations; to note the difference in size between the small comb of the Plymouth Rock, the medium to large comb of the Leghorn, and the very large comb of the Black Minorca. Request the pupils to name the breeds in which the comb of the female lops and those in which it is upright, as shown by the illustrations. Ask some of them to draw combs of males and females of the different breeds and then ask other members of the class to say which are males and which are females and to give the reason.

FIG. 2.— *White Leghorn*

Single comb, medium to large, five points, deeply serrated. Comb of female lopped

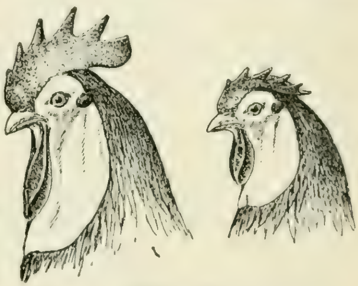


FIG. 3.— *White-Faced Black Spanish*

Single comb, medium to large, five points. Comb of female lopped

2. *The rose comb.*— A thick, solid comb, covered at the top with fine points and terminating in a conspicuous spike in the rear (Figs. 5, 6, 7). The rose comb is to be found on the Wyandotte (Fig. 5), Rose-Comb Leghorn (Fig. 6), Hamburg (Fig. 7), Dominique, Rose-Comb Rhode Island Red, Rose-Comb Black Minorca, White Dorking, and others.

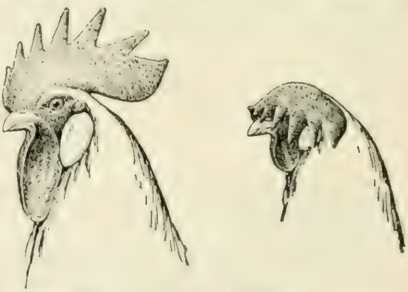


FIG. 4.— *Black Minorca*

Single comb, very large, six points, deeply serrated. Comb of female lopped

Ask the class, among other questions, to explain the difference in the shape of the comb of the Wyandotte (Fig. 5), Leghorn (Fig. 6), and

Hamburg (Fig. 7). Suggest that they draw the three types of comb and name the breed on which the spike points downward, straight back, and upward, respectively.

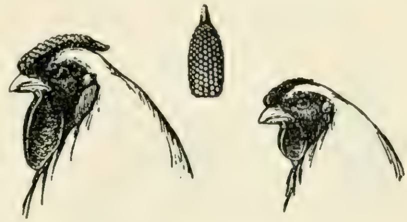


FIG. 5.— *Wyandotte*

Rose comb, low, medium, oval, spike following the curve of the head

3. *The pea comb.*— A comb resembling three low, thick, slightly serrated, single combs, grown together, the center comb being slightly higher than the other two (Fig. 8).

The pea comb is found on only a few breeds, the most common being the Brahma (Fig. 8), Indian Game, Buckeye, and Sumatra.

FIG. 6.— *Rose-Comb White Leghorn*

Rose comb, medium to large, flat top, finely serrated, point horizontal

4. *The "V" comb.*— A comb consisting of two small, divided, horn-like or leaf-like projections, varying in size and shape with the different breeds. Found only on La Flech (Fig. 9), Houdan (Fig. 10), Crevecoeur (Fig. 11), Polish, and Sultan.

FIG. 7.— *Hamburg*

Rose comb, medium to large, flat top, finely serrated, spike inclined upward

The Polish and the Houdan have combs consisting of very small, horn-like, projecting points extending upward like a small "v" (Fig. 10).

The La Flech has larger horn-like points projecting backward and upward so as to form a large "V" (Fig. 9).

The Crevecoeur has a larger fleshy comb, irregularly shaped, similar to an oak leaf (Fig. 11).

The Sultan has two very small spikes arranged in the form of a "V."

FIG. 8.— *Brahma*

Pea comb, medium, evenly and slightly serrated in three rows

Ask the class to point out, name, and draw on the blackboard the different types of V-shaped combs as shown in Figs. 9, 10, and 11, and to state the breed on which each may be found.

5. *The strawberry comb.*— A fleshy growth so named because of its similarity in shape and color to a ripe strawberry. Found only on the Malay (Fig. 12) and the Silky.

The "American Standard of Perfection," published by the American Poultry Association, contains illustrations and detailed descriptions of all the principal breeds and varieties of poultry.

FIG. 9.— *La Flech*
V-shaped, medium spike comb, medium to small size

FIG. 11.— *Crevecoeur*
V-shaped, medium leaf comb, medium to small size

FIG. 10.— *Houdan*
V-shaped, very small

FIG. 12.— *Malay*
Strawberry-shaped, small, symmetrical, finely serrated, set slightly toward the front of the head

Editor's Note.— All lessons on poultry should have relation to real live material. A visit to a poultry yard should be made and, if possible, a simple survey of the poultry industry of the community should be worked out. This will result in an awakened interest in the study of all fowls; boys and girls will look on a hen in a new light and on the basket of eggs on the pantry shelf with new intelligence.

"What is all nature and human life at this moment, what the scenery and vicinity of a human soul, but the song of an early sparrow from yonder fences, and the cackling hens in the barn? So for one while my destiny loiters within ear-shot of these sounds. The great busy Dame Nature is concerned to know how many eggs her hens lay. The Soul, the proprietor of the world, has an interest in the stacking of hay, the foddering of cattle, and the draining of peat meadows. Away in Scythia, away in India, they make butter and cheese for its larder. * * * Was not Christ interested in the setting hens of Palestine?"

Thoreau, Journal

EGG TYPES

James E. Rice

Object.— To train the pupil's power of observation, especially his ability to recognize differences in size, weight, form, color, and texture of eggs; to familiarize him with the characteristic types of eggs laid by the different species, classes, breeds, and varieties of domestic poultry; to note variations from the normal eggs, and to lead the pupil to inquire into the causes for those that are abnormal; to afford the pupil training in accuracy of expression in the words used to describe the various forms, colors, and textures of eggs.

Materials.— 1. A collection of eggs from as many different kinds of poultry as it is possible to procure. Eggs from the domestic fowl, ducks, geese, turkeys, guineas, pheasants, pea fowl, pigeon, and quail, and also from many different breeds and varieties of each of these kinds of poultry.

2. One or two insect cases (Fig. 2). If insect cases cannot be obtained, a neat box that can be covered tightly will do.

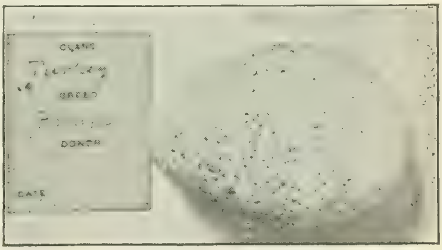


Fig. 1.— *A specimen for the egg collection*

3. Several egg drills and blowpipes. These instruments are not very expensive. They can be purchased at Ward's Natural Science Establishment, Rochester, New York, for twenty-five cents each. The writer has known young persons, however, who could blow the contents from an eggshell with a straw without the aid of drills or blowpipes.

4. Pot of glue. Labels, as shown in Fig. 1.

5. Drawing paper, drawing pencils, lead eraser, and color crayons or water colors to be used when pupils have had sufficient training in color work.

6. One pair of balances or scales.

The collection of eggs can be made permanent by blowing the contents from each egg and mounting the shell on a wooden block. (Fig. 1.) The mounted eggshells can then be arranged in an insect case (Fig. 2), each egg being properly labeled as follows: species, breed, variety, date, name of breeder, and pupil who prepared the specimen. In this form the eggshells may be safely kept in the schoolroom, where they make an attractive and instructive collection for general observation when not desired for class instruction. From time to time pupils will be able to add to the collection. When eggs are brought in from the poultry house to

be used for cooking, perhaps the contents of some of the eggs can be blown out and the shells added to the collection. They should always be properly labeled.

Method.— (a) The size, weight, and form of eggs.

Make outline drawings, natural size, of as many different kinds of

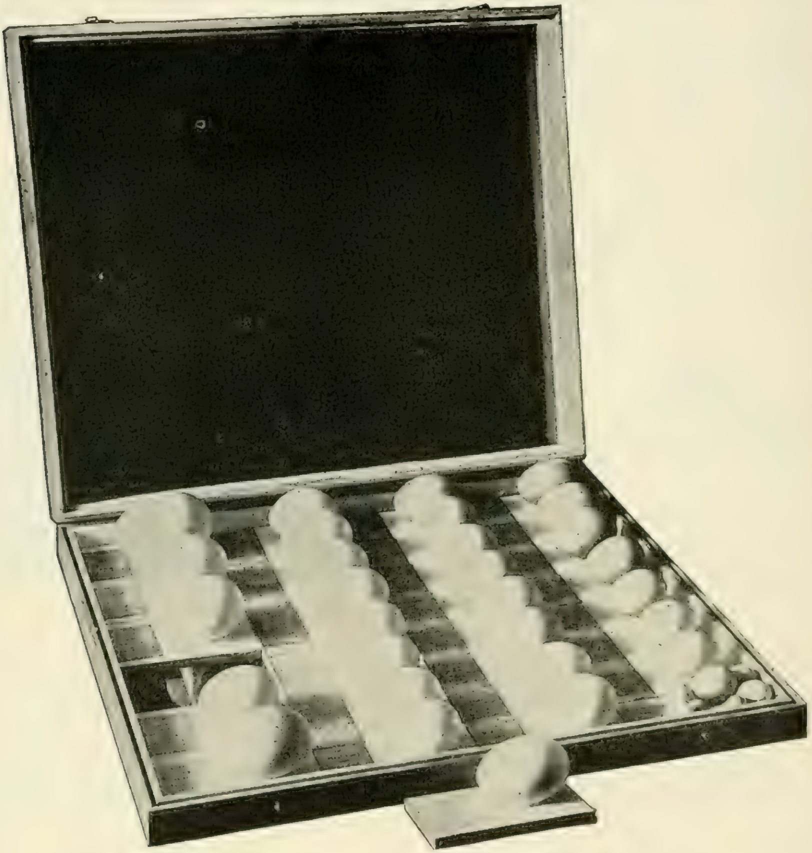


FIG. 2.— *A collection of eggs for study*

eggs as the time will permit. Place several eggs representing different types side by side and observe the different outlines.

Select one dozen eggs each of large, medium, and small sizes. Weigh them and estimate the loss or gain if they had been bought by weight instead of by the dozen. A dozen hen's eggs should weigh one and one half pounds, or twenty-four ounces, equal to two ounces each.

Describe the different forms of the eggs by suitable descriptive terms, such as elliptical, round, elongated.

Place the eggs of different sizes side by side and note how, by the law of contrast, the small eggs look smaller when compared with the large eggs than they do when seen in a group by themselves. It pays to produce eggs of uniform size and shape, and to grade eggs carefully before marketing them.

(b) Color of eggs.

Compare the variations in color of the different collections of the different kinds of eggs. Represent these by giving the proper tint to the eggs already drawn in outline.

Arrange the dark-colored and the light-colored eggs in such a manner that there shall be a perfect graduation and blending of colors from the darkest brown to the purest white. Note the great contrast in color when the brownest and the whitest eggs are placed side by side. Group the tinted eggs together and note how much darker the light brown eggs appear when placed by the side of the white eggs than they do when placed by the side of the brown eggs. Note also how much darker the whitish eggs appear when contrasted with the pure white eggs than they do when seen by the side of the light brown eggs.

Observe how much more attractive a dozen pure-white eggs and a similar number of brown eggs appear when grouped alone than they do when mixed together. Those who sell eggs find that it pays to provide eggs that are uniform in color.

(c) Texture of eggs.

Note the differences in texture of the eggshells from the different kinds of poultry — the glossy, the smooth, the rough, the thick, and the thin shells. The differences in texture of the shell are usually breed characteristics and may be used to determine the kind of fowl that laid the egg. Sometimes fowls lay eggs which have abnormal shells because there is a deficiency in lime due to improper feeding. In this case the eggs are not likely to hatch well or to produce strong chickens if they should hatch. Only those eggs that are perfect in the size, shape, color, and texture characteristic of the breed should be used for hatching purposes. A hen is likely to produce eggs which in every respect are similar to the egg from which she herself was hatched.

(d) The kinds of eggs laid by the different species, breeds, and varieties.

Cover the label which tells the kind of fowl that laid the egg and give each egg a number.

Hand each pupil a paper on which to write the number of each egg and the name of the fowl that laid it. The papers can then be corrected by permitting the pupils to exchange papers and mark "correct" or "incorrect" as the teacher holds up the egg to the class and gives the name of the fowl that laid it.

PRACTICAL LESSONS

I. IMPROVING THE QUALITY OF POULTRY

JAMES E. RICE

We should aim to retain purity of breed and vigor of our stock, and to have high-grade market quality in our poultry and eggs. By so doing, the profits may be greatly increased and the losses reduced because the selling value of the product will be increased. We shall also get more pleasure and satisfaction out of our occupation because we shall take pride in the improvement made. The difference in price between poultry and eggs that are attractive and those that are unattractive is enough to warrant great care in breeding for improved quality.

A flock of miscellaneous colors and types, such as is often found on the average farm. Cockerels of this sort are of no value as breeders and are poor ornaments

Some of the reasons why pure-bred poultry is more desirable than common stock are: 1. Pure-bred fowls lay eggs that are more uniform in size, shape, color, and texture of shell. Uniform eggs sell for a higher price. 2. They are more likely to breed true, that is, the chickens will grow up to be like their parents. 3. They are more nearly uniform in shape and size of body and in color of skin and shanks, therefore more attractive and more profitable when placed on sale. 4. They are more attractive as a flock, because they are similar in appearance. It is worth while to keep poultry that looks well. 5. They furnish a larger income because eggs for hatching and stock for breeding can be sold at prices considerably higher than for market purposes. 6. They are more satisfactory, because, other things being equal, they may be expected to give better

A flock of pure-bred Barred Plymouth Rocks. Note the beauty of a flock like this, as compared with a flock of mixed breeds

results in feeding, hatching, and rearing, due to the fact that they are more nearly alike as to rate of growth, size, temperament, activity, and the like.

What can we do to improve our poultry?— Any boy or girl who is old enough to take care of chickens can improve the quality of poultry in two ways: first, by keeping only pure-bred stock and by selecting, mating, and taking proper care of them; second, by selecting and using only the right kind of eggs for hatching. Both these things should be done, but either one alone will be likely to result in sufficient improvement to warrant the effort of doing it. We should keep a pure breed instead of common mongrel fowls. This is within the reach of all. It is neither difficult nor expensive to obtain in any neighborhood a few pure-bred fowls or their eggs. With these a small start can be made. Each year more and more pure-bred chickens can be reared to take the place of the common fowls until all the flock are pure-bred.

Find out for yourself, by trying, whether it will pay better to have a pure breed of poultry. Remember, however, that not all pure-bred fowls are good fowls. Whether we have pure-bred or mongrel stock they must be strong, vigorous, and healthy.

II. SELECTING AND KEEPING EGGS FOR HATCHING

JAMES E. RICE

One of the easiest ways to increase the money-earning value of poultry is to improve the quality of their eggs. The best customers usually are willing to pay a higher price for eggs of superior quality. Frequently this difference in price is as high as five to ten cents a dozen. Each hen in a good flock should lay on the average ten to eleven dozen eggs a year. If the eggs are of such quality that they will sell for even two cents more a dozen than ordinary eggs, this would mean a net difference of about twenty-five cents a hen in a year. This extra price is nearly all clear profit, due to the uniformity in size, shape, and color of the eggs.

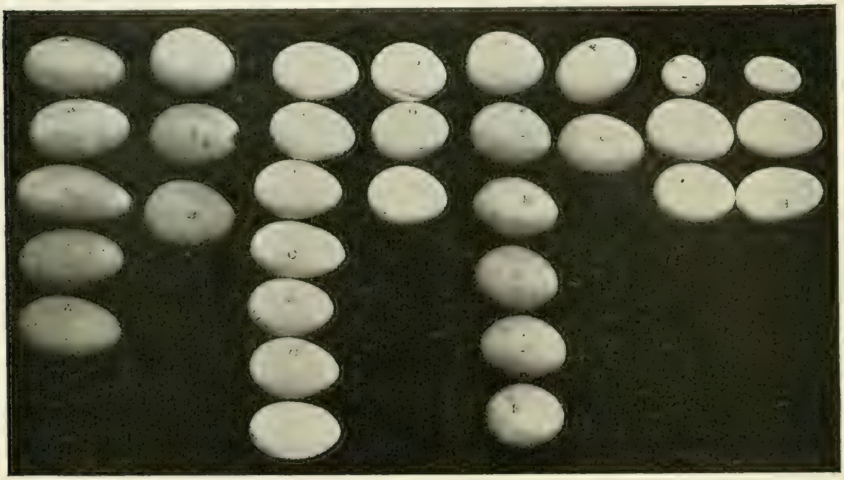
The eggs that bring the highest price will depend somewhat on the market (see Lesson XI). We must first find out what kind of eggs will bring the highest price and pay the largest profit in our market, and then produce that kind only.

There are several things that we can do which will help to improve the selling quality of the eggs:

1. We should keep a pure breed of poultry that will lay eggs as nearly as possible the right size, shape, and color to meet the requirements of our market. Such fowls cost little, if any, more to keep than fowls that lay an inferior quality of eggs.

2. Only those eggs should be used for hatching that are of best market type as to size, color, and texture. Pure-bred fowls will be likely to lay eggs similar to the eggs from which they were hatched. In other words, the kind of eggs that we select for hatching will determine the kind of eggs that will be laid by the chickens that are hatched from the eggs.

When eggs from the same variety of fowls are compared, the size of an egg apparently determines to a considerable extent the size of the chicken that will hatch from it. Therefore, if we wish to have chickens of good size we must set good-sized eggs. Hence, we see that there are at least two good reasons why all the eggs that are selected for hatching should be full size, perfect in shape, and of the right color and texture.



Groups of eggs showing the various sizes and shapes that are obtained from almost any flock. All the eggs in the same row were laid by one hen. Note that the eggs laid by one hen have a characteristic shape. Only uniformly shaped eggs should be marked as first class

Eggs for hatching should weigh at least two ounces and should not exceed two and one half ounces each. They should be perfect in shape so that they will pack well in the shipping case, that is, so that they will fill the compartments without danger of breakage from top or side pressure. They should be uniform in color, that is, each egg should be of one color and the right color over its entire surface, and all the eggs should be of the same color. The two colors that are most in demand are pure white and pure brown. There are many degrees of white and of brown in eggs, which will be seen only when the eggs are carefully examined in a good light.

The texture of the eggshell should be smooth, hard, and free from transparent spots when examined with a tester. Eggs having defective shells are not so likely to hatch well or to produce strong chickens.

Eggs for hatching should be kept in a moist, cool place not over 50° to 60°, and for not more than a week or ten days if it can be avoided. They should be turned every day or two, and should be kept covered so as to prevent too rapid evaporation.

Selecting eggs for hatching is interesting and useful work for any boy or girl to do. It will also prove profitable work. How many will do it and do it well?

III. HATCHING EGGS

Clara M. Nixon

Every one who has tried to set and care for a hen so that a good brood of healthy chickens will hatch, knows that it is no slight task. We need education for this as well as for other lines of work. Let us see what we can learn in the following lesson:

The hen.— You will probably have the hen all ready to receive the eggs when they arrive. She should be of moderate size. If too heavy, she may break the eggs; if too small, she can cover a few only. She should be quiet and peaceable, a hen that may be handled without being frightened, and one that is likely to pay strict attention to business.

Do not trust the hen with valuable eggs until you are sure she intends to sit. It will be better to give her two or three other eggs (china eggs will do) and let her sit on these for two or three days. She will probably be more contented on the nest that she has chosen for herself, if it is a suitable one.

In case you must change the hen to another place, go quietly after dark, lift her gently, and put her on the nest that has been prepared. Give her two or three eggs, one at a time, and let her place them under her breast as best pleases her. If she clucks contentedly, and snuggles the eggs cozily under her feathers, she will usually sit on this nest. It is best, however, to put a crate or well-ventilated box over the nest. The top should be high enough not to disturb her while sitting, but not high enough to allow her to stand comfortably. If she sits quietly for two or three days, she will probably stay, and you may give her the eggs. Keep the crate over her for a few days longer, allowing her to get off the nest every day for exercise, food, and water, but have her go back in a reasonable time.

Sitting hens should be separated from the rest of the flock and placed in some quiet, cool retreat

The nest.— Have the nest comfortable, clean, and free from lice. It should be large enough for the hen to change her position on the nest and to turn her eggs, but not so large that the eggs will move out of the warm hollow under her breast. First, place some earth in the bottom of the box, then enough bright clean hay to make a good nest; the hen will fix the curve of the nest to suit herself. She feels safer in a somewhat dark, secluded place, and it is best to humor her.

Care of the hen.— The hen has undertaken a very confining task, which will last three weeks. This is a long time. For twenty-one days and nights the patient hen must stay in almost the same position. If you do not think this is tiresome, watch her when she first comes off the nest. She can scarcely stand. The least that we can do is to have things as well prepared for her comfort as we can. Plenty of whole grain (corn and wheat are best), clean, fresh water, grit, and a dust bath should be placed where she can reach them, and she should be allowed to exercise every day if she wishes. Be sure to dust a little insect powder into her feathers occasionally. This is a wise precaution, even if you do not find any lice. In case she should break an egg, clean up the nest as well as you can, and wash off the badly smeared eggs in lukewarm water. They will not be likely to hatch if not cleaned.

If the hen seems irritable when the eggs begin to hatch, the oldest chickens may be taken from the nest as soon as they try to get from under the hen, wrapped in a piece of flannel, and kept in a warm place until the others are out. This will keep the hen more quiet, and she will not be likely to kill the younger chickens in the nest or to leave the nest before the remaining eggs are hatched. If the hen is quiet it is best not to disturb her while the eggs are hatching. The nest box must be deep enough to prevent the chickens from jumping out.

With careful attention to the instructions given, you should have good success with the eggs.

IV. BROODING AND CARE OF CHICKENS

CLARA M. NIXON

When the eggs are hatched, as they should be by the end of the twenty-first day, take the hen and chickens from the nest and put them in the coop that you have prepared for them.

The coop.— The coop should be large enough to permit the hen to move about, and high enough for her to stand comfortably in it. If it has no floor, set the coop on a platform of boards. This will help to keep out the rats and weasels, as well as to keep the coop dry. The separate floor is more easily cleaned and dried The coop should be slatted in front, but closed on the other sides; it should have a roof that will keep out the

rain. It should face the south and be placed on clean land on which no chickens have recently been reared. This is a precaution against disease. Everything should be clean, thoroughly disinfected with a coat of whitewash, and kept dry. *Dampness is fatal to young chickens.*

During hot weather a shelter against the heat should be arranged on the south side, unless the coop is located in the shade. The coop should be turned over often and the floor set up on edge, so that the sunshine may dry and cleanse every part.

The coop and the water fountain

Care of the hen and chickens.— It is better to keep the hen in the coop for a few days, for she will then be likely to return to it. Let the chickens run if the weather is fine; they will not go far from the hen. In case the winds are cold, a little yard covered on the sides with coarse muslin instead of chicken wire will give protection. As soon as the chickens can run well the hen may be allowed her freedom in fine weather, but she should be fed near the coop. In rainy weather it seems best to keep the hen and chickens out of the wet.

Enemies and disease.— Be sure that the hen and chickens are free from lice. A wise precaution against these pests is to apply a little fresh lard to the hen's body under the wings. An equal quantity of scotch snuff mixed with the lard makes it more effective. A liberal application of kero-

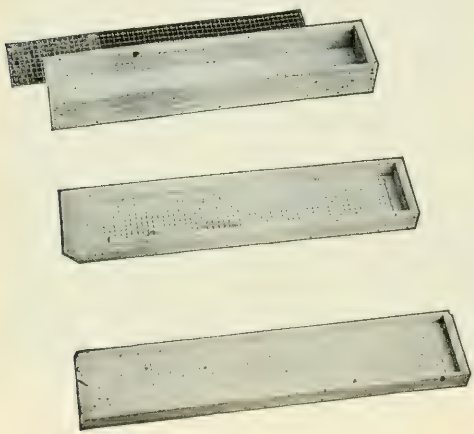
sene and whitewash to the inside of the coop several days before the hen and chickens are placed in it will be a wise precaution against red mites.

In case of the mysterious disappearance of the chickens, look for cats, rats, crows, hawks, weasels, and other thieves. Crows and hawks catch the chickens in the daytime, when they are roaming about. Rats and weasels often get into the coop at night, and may destroy an entire brood in one visit. Cats are often enemies. Your pet cat may be the one to eat your chickens. Watch her until you know she is to be trusted. The loss from disease will be greatly decreased if the chickens are always well cared for and well fed and if their coops are kept clean.

V. FEEDING CHICKENS

Clara M. Nixon

The food.— The egg yolk is enclosed within the body of the chicken just before hatching, and may supply nourishment to the chicken after it leaves the shell. For this reason chickens should not be fed until they are thirty-six hours old. The first meal may be of equal parts of bread crumbs and rolled oats, moistened with some milk or water to make the food crumbly but not wet. Sprinkle over this food a little fine sand or grit, fine charcoal, and some finely shredded clover, lettuce, or chickweed leaves. Mix with the food a little well-burned bone or some bone meal. After the first few days, hard-boiled egg may be added in the proportion of one part of egg to eight or nine parts of the bread and rolled oats. In addition to the moist food, a grain food should be given. A mixture of three pounds cracked wheat, two pounds corn (finely cracked), and one pound pinhead oatmeal, rolled oats, or hulled oats is good. A dry mash may be left before the chickens at all times, but only as much should be given at one time as will be eaten in a day. If any of the mash becomes dirty it should be taken away from the chickens. The mash may consist of four pounds wheat bran, three pounds wheat middlings, three pounds corn meal, three pounds sifted beef scrap, and one half pound bone meal, well mixed together. Beef scrap that is not perfectly good and fresh should never be used.



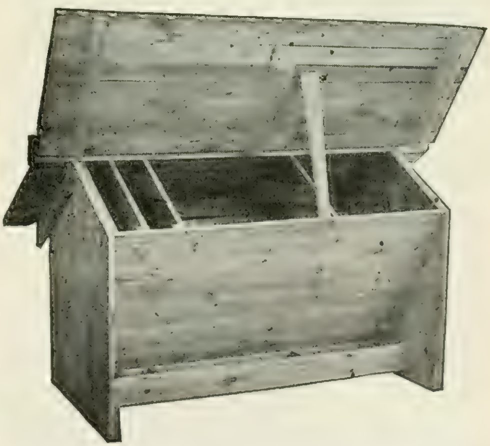
Chick feed-trays of different sizes

For chickens four weeks old or over, the bran may be reduced to three pounds. Cottage cheese may be given in addition to the other foods, but not in large quantities. It may cause bowel trouble if the chickens get too much at first. *All foods should be sweet and clean, never moldy nor sour.* Make all changes in ration gradually.

Troughs for feeding large chickens

The feeding.— Care should be taken to have the hen well supplied with whole grain and large grit. The chickens should be fed often at first, usually five times a day. The moist food may be given in a shallow dish or on a bit of clean board, and should be taken away as soon as all the chickens have had enough. During the first few days they will probably eat but a small amount of grain, and it may be scattered in a shallow dish containing a little dry mash made according to the directions given above. After two or three days, the dry mash by itself may be fed in the dish, and the grain scattered on the ground or floor. Two other meals of the moist food may then be given, the other feedings being of grain. The dry mash may be left where the chickens can get it at any time. After the first week the bread and rolled oats need not be given, but a little of the mash mixture may be moistened and given instead.

As the chickens grow older the number of meals may be less, and the grain of larger size. At four or five weeks of age they will be able to eat whole wheat, hulled oats, and larger cracked corn. Then if they have a large range and the weather is favorable so that they may run about, they need only two meals of grain and one of moist mash a day. They can always come back to the dry mash if they get hungry. Beginning with the first meal, green food should be supplied, but the hen will soon teach the chickens to peck tender pieces of clover and the like if she is allowed to range with the brood.



An outdoor hopper for feeding mash, grain, grit, and bone meal

When the chickens are about eight weeks old the grain and ground food may be fed from a large feed hopper, from which the chickens may help

themselves at any time. The grain mixture may consist of equal parts of wheat and cracked corn. The chickens should also have free access to cracked bone, fine grit, screened oyster shell, and charcoal.

Give plenty of fresh, clean water in a vessel into which the chickens cannot jump. Ordinarily a water fountain is used for the purpose.

A serviceable water fountain can be made from a pint basin and a tomato can that does not leak. Cut half-inch notches in the edge of the can on opposite sides. Fill the can with water, cover with the inverted basin, then turn the whole over, holding basin and can tightly together. The water will run into the basin but will not overflow. If the basin does not become full enough, cut the notches higher.

VI. FALL PREPARATIONS FOR WINTER EGGS

JAMES E. RICE

The early fall months should be one of the busiest seasons of the year for the boy or girl who is taking care of poultry. It is a most delightful time to work out of doors. In the North when fall comes we feel the hibernating instinct of squirrels. We enjoy "snugging up" as the days get shorter and the frosts remind us that winter is coming. We know from experience how good it feels at this time to be comfortable. The hens feel the same way. Notice how they seek the shelter of bushes, fences, and buildings. They know full well that this is no time to lay eggs or to rear a brood of chickens. Therefore, what they do is perfectly natural and excusable, from a hen's viewpoint: they stop laying. Hens everywhere do the same; that is why eggs are always high-priced at this season of the year and later. In New York State the season of low egg production is October, November, and December.

A cheap and very satisfactory type of henhouse. It is neat and warm and gives opportunity for fresh air for the fowls

Did it ever occur to you that hens commence to lay less about the last of June each year, when the days begin to get shorter, and that they naturally begin to lay more about the first of January, when the days lengthen? They apparently know by the amount of daylight and of sunshine when a more favorable or less favorable season is approaching.

Hens lay well only when they are comfortable and happy. The happy, singing hen is the laying hen. That is why great care is necessary in the fall in getting fowls into congenial winter quarters early. There are many ways of doing this. One is to provide them with a cheerful, cozy, clean house in which they can be sheltered from the wind, have plenty of sunshine and fresh air, and at the same time have an opportunity to run out of doors. On the snow? Yes! Yes! A hen does not mind cold feet if she can have her own way. In some respects, hens are like human beings. It is not so important for a hen to go out of doors each day the year round as it is for her to know that she can if she wants to. Hens will not lay well unless they are contented, and freedom helps to make them contented.

There are many things to be considered in making a home for hens. The word *home* instead of *house* is used because many expensive houses are not hen homes; they may look all right, but they are too high or too dark or too damp or too dirty. The home of a hen should be low, bright, dry, and clean, and have neat nests in which the birds can hide their eggs. The location should be dry and sheltered and should have good air drainage. Many of the most troublesome poultry diseases are due primarily to improperly located and poorly constructed poultry houses. The walls must be built so as to provide warmth, dryness, and strength for the house, ease of cleaning and disinfecting, economy in construction, and durability. Interior fixtures should be portable, in order to facilitate fighting the mites. A dust wallow should always be provided.

VII. WINTER QUARTERS FOR PULLETS

C. A. ROGERS

As the fall advances and the leaves on the trees drop to the ground, it is time to get the season's flock of pullets into cozy, warm quarters where they can spend the winter in comfort. This is a time when the chickens should be given careful attention, for when exposed, the cold nights and occasional snow flurries soon put a stop to their growth and development. It is also a critical time, for under favorable care they should soon begin to lay.

Before putting pullets into winter quarters, the houses should be thoroughly cleaned and disinfected. New litter should be put in and all signs of disease destroyed

The pen.— Choose, then, a corner of the barn or shed

that can be partitioned off into a pen of the desired size; or, better still, build a small house purposely for the pullets. If you have fifteen fowls, build the house eight feet wide and ten feet long. If there are twenty-five fowls, make the house twelve feet wide and twelve feet long. Be sure to build it on a dry place that is protected from the cold winds as much as possible. Have the front face the south in order to get all the warmth of the sun's rays.

Fresh air and sunlight.— These are two very important factors. Both should be provided through windows on the front (south) side. A small window may be made near the top, into which is fitted a cloth curtain frame. During the daytime in pleasant weather this curtain should be removed or swung on hinges or fastened up out of the way, thus letting in the sunshine and fresh air. At night when closed, the muslin cloth keeps the house warmer and still allows abundant circulation of air. In addition to the cloth curtain there should be a glass window with six-by-nine-inch panes for the houses mentioned. For best results this window should be placed one and one half foot above the floor, with the longer dimensions up and down.

Warmth.— Next in importance is the warmth of the pen, on which depends largely the coziness of the quarters. One of the easiest ways of insuring this is to line walls with paper and board up roughly. In addition to this, if the roof is high build a loose ceiling at a height that allows plenty of headroom. Fill the space above with straw.

Dryness.— The straw not only makes the pen warmer, but also keeps it dry. Dryness is equally as important as warmth. With the three walls made tight with paper, the ceiling filled with straw, and a deep litter of straw or hay chaff on the floor, the fowls will be more comfortable and contented. Such conditions always add to the number of eggs in the egg basket.

Roosts.— Make the inside arrangements neat and convenient. Small poles or two-by-four sticks of lumber make the best perches. All perches should be on the same level, because fowls seek to roost on the highest if some are higher than others. The scrambling for the higher places often results in injury to some fowls and always causes disturbance. The best height for the perch is about two and one half feet above the floor.

Nests.— By natural instinct hens seek a secluded place in which to lay eggs and this should be provided. They will be likely to lay more eggs when satisfied with their surroundings. An easy way to make such a nest is to fasten a box on the side wall at about the same height as the perches, leaving a small opening at the side of the box toward the back wall through which the hen enters and from which the eggs can be gathered. The nest is very inviting when kept clean and filled with fresh straw or hay.

Freedom.— Fowls should be given their freedom in winter as well as in summer. This is particularly desirable when the house opens into a dry barnyard in which the fowls can roam about and pick up bits of food left by the other animals.

Cleanliness.— The pen *must* be kept clean. The health and comfort of the fowls depends very largely on this. Do not wait until the litter becomes wet and filthy, but change it as soon as it begins to pack. Provide a small box of screened coal ashes or road dust in which the hens can dust. This will help to keep the lice off their bodies. Whitewashing the house will help to keep the lice in check; if necessary, put kerosene on the perches and over the nest boxes, refilling the nests with clean bedding. The whitewashing is very desirable, since it makes the pen lighter and cheerier, and kills most of the vermin.

By the above method, the pullets can be made comfortable for the winter at a very small cost. The one thing before all others which young poultry-raisers should remember is: *Provide your fowls with wholesome surroundings and they will make it worth your while to keep them.*

VIII. FEEDING FOR WINTER EGGS

C. A. Rogers

Does it ever occur to boys and girls that fowls are fond of a variety of food? This is especially so when the weather becomes cold and they are shut up in their pens. Then they are away from the fields where in summer they can nearly gain a living on bugs, scattered grain and seed, and grass. It is true that they will subsist, even in the winter, on corn and water given them at irregular intervals, but under such care they cannot lay eggs. Notice how much better you feel after eating a meal of wholesome, well-cooked food that you like. Fowls are just as partial, and respond when well fed. There is no one method of feeding that can be applied equally well under all conditions. The method described in the following paragraphs, however, may be followed to advantage under many conditions and may also serve to suggest ways of improving your present practices.

Morning feeding.— In the morning the fowls are hungry and ready to work for their breakfast. It is well to let them keep as busy as possible. Work keeps them warm, healthy, and contented. With this in mind, scatter mixed grains in the litter. Be rather sparing of the feed in the morning, so that the fowls will not quickly obtain their fill but will continue to work and hunt for the grain for the greater part of the forenoon. This grain should be a mixture of all the kinds grown on the farm. They may be mixed in the proportion of three pounds corn, two pounds wheat, and one pound oats, to which may be added, if available, one pound buck-

wheat and one pound barley. Fresh water should be given to the chickens every day.

Noon feeding.— At the midday meal is the best time to provide those appetizing mixtures so greatly relished by the fowls and so successful in helping to produce eggs. Take the scraps of meat, bread, and vegetables, or oatmeal, from the table, mix them with corn meal, wheat bran, and wheat middlings. Moisten the mass with skimmed milk until it is crumbly. When skimmed milk and table scraps are not to be had, take a pail of cut alfalfa or clover hay and pour boiling water on it, allowing it to steam. Feed when it is still warm. A portion of this steamed alfalfa added to the noon mash gives it a pleasant, appetizing odor. A little salt and pepper can also be added to the mash, in about the same proportion as would be used in your own food. When it is not convenient to make a moist mash, the same ground feeds may be fed dry in a hopper that should be left open during the afternoon. A good mixture for this purpose is: six parts corn meal, six parts wheat middlings, three parts wheat bran, five parts meat scraps, one part oil meal. The best results will be obtained if the hens eat about one third of the ground feed mixture to two thirds whole or cracked grain. At noontime as much green food (beets, cabbage, or lettuce) as the fowls will clean up before the following noon should be given. At this time see that the oyster-shell and grit hoppers are filled. When it is impossible to follow the practice of feeding three times a day, the scraps and green food should be given with the morning feed.

Night feeding.— Fowls go to roost very early, making it necessary for them to eat before sundown. This requires feeding in the latter part of the afternoon, while they can still see to pick up the grain. When given the opportunity, a fowl will go to roost with its crop rounding full of grain, which it gradually digests during the night. This process of digestion warms the body and keeps it more comfortable. An empty crop is a poor bedfellow for the fowl. The same grains can be fed at night as in the morning, but in large quantities so that some will be left over after the fowl's appetite has been entirely satisfied.

IX. ELIMINATING UNPROFITABLE CHICKENS

JAMES E. RICE

In nearly every flock of chickens or fowls there are good ones and poor ones; in some flocks there are very good ones and very poor ones, and occasionally there are flocks in which there may be found greater extremes than these. Very likely the good ones are profitable and the poor ones are kept at a loss. If we are to make money from our fowls or chickens we must not keep any that are not profitable.

Every chicken should be regarded as a living machine for transforming food into chicken meat or eggs. Unless we have a good machine we cannot get good results from the food. In the case of many flocks of chickens a division may be made into three groups: (1) chickens that are growing or laying; (2) chickens that are not growing nor laying; (3) chickens that are losing weight and not laying. All three of these groups are eating valuable food, and if we keep all of them together they will probably eat more than they earn. If we dispose of the third group the others may pay expenses. If we remove the second and third groups the first group alone should pay a good profit. We shall have one third as much work to do in caring for those that remain, and the chickens will have two thirds more room. Moreover, the flock of good chickens by themselves will look far more attractive, will grow better, lay better, and be less likely to suffer from disease than they would be if kept with the others.

Strong Weak

Cockerels

There are several types of unprofitable chickens that should not be kept:

1. A chicken of any breed or age that shows signs of sickness or weakness. All such should be removed at once and doctored, or killed and burned. Prompt action may prevent further trouble. Delay is almost certain, in the end, to have serious results for the rest of the flock.

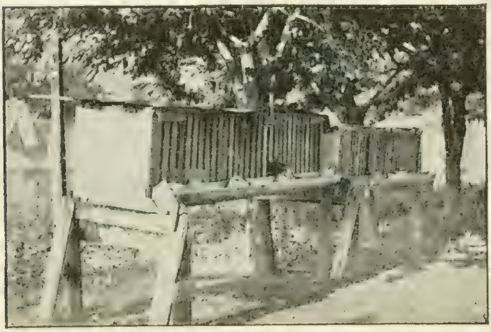
2. Old hens that may still be well and strong. Generally it does not pay to keep hens after they are two or three years old unless they are strong and especially valuable for breeding purposes. Fowls should be marked so as to indicate their age.

3. Surplus cockerels are unprofitable boarders. It is a common mistake to keep too many males. This is frequently due to a natural desire to avoid killing desirable breeders, and with a hope that if they are retained they may be sold alive for high prices. After they become large enough for market most cockerels do not make enough growth to pay for the food that they eat. They also injure themselves or others by fighting. The room that they occupy, the food that they eat, and the labor that they require might better be bestowed on early-hatched pullets. They should seldom be allowed to go into winter quarters. They usually fail to grow well in cold weather, and occupy valuable space that should be used by better stock. They are unable to wrestle with larger individuals and generally remain undersized.

X. FATTENING POULTRY

W. G. KRUM

By fattening we do not mean filling a fowl's body with a large deposit of oily fat such as is often found in old hens, but producing large, soft muscles with sufficient fat so that when cooked they will be tender, juicy, and of fine flavor. Not only does this improve their quality for home use, but they will sell in good markets for a much higher price per pound.



Shutting birds up in coops or small pens is very satisfactory when fattening them. The coops should be arranged in the shade. By means of troughs, wet mash may be fed three times a day

The best method of fattening poultry is to restrict exercise by placing them in slatted coops about two feet square, having the bottom slatted or covered with one-half-inch-mesh wire cloth. This will hold four to six fowls or eight to ten young birds.

The fattening coop should be located in a cool, shady place in hot weather and in a comfortable place in cold weather.

The fowls should be thoroughly dusted with lice powder, as fowls infected with lice do not fatten well. Neither do fowls or chickens of low vitality fatten readily.

Poultry should not be fed for twenty-four to thirty-six hours before feeding the fattening ration. The ration should be fed sparingly at first. Afterwards the fowls should be kept eating well by feeding only as much as they will clean up in ten to twenty minutes. If they have more than they can digest for a meal or two they lose their appetite, fail to grow well, and may lose weight.

Feed fowls or mature young stock three times daily for about two weeks, this being continued as long as they will do well under such heavy feeding.

A good ration consists of three pounds corn meal, three pounds buckwheat middlings, three pounds oat flour, one pound beef scrap, and a little charcoal. These are mixed with sour skimmed milk or buttermilk (the latter preferred) to the consistency of batter, which is then allowed to stand and sour twelve hours before feeding.

Ten pounds of feed usually requires seven to nine quarts of milk. The oat flour may be obtained of manufacturers of oat flakes or oatmeal. Flour middlings may be used in the place of oat flour, although it is not quite so satisfactory a food.

It is usually best, in fattening broilers, to give this ration morning and night only, giving at noon a light feed of cracked corn and wheat.

When stock fattened in this way is shipped to market the packages should always be marked "Milk-fed." This will bring the best prices.

XI. GRADING AND PACKING EGGS FOR MARKET

E. W. BENJAMIN

In order to sell eggs most profitably, you should know how to grade and pack them for market.

As soon as the eggs are gathered, sort out all the soiled ones and clean them. If they are only slightly stained, use a cloth moistened in water; if they are badly soiled, use scouring soap or similar substance. Do not soak the eggs in water, as the liquid will pass into the interior of the egg carrying undesirable flavors. Washed eggs will not keep so well as clean, unwashed eggs; therefore it is better to keep the washed ones for home consumption and use them while they are fresh.

First-class eggs may be enclosed in neat cartons and delivered to private customers. Prices well above market quotations are often obtained for this grade of eggs

Market eggs should be kept in a cool place and sold at intervals of not more than one week. These eggs should be carefully sorted and packed. In order to grade eggs for private trade, make two groups according to size. The first group should contain eggs each weighing two ounces or more, that is, one and one half pound or more per dozen. The second group should contain eggs weighing less than two ounces each. The grading will be easier if you weigh a few eggs of two ounces each and use them as samples. Practice will enable you to select the eggs of various grades without weighing them.

From each group of eggs take out those having approximately the same color (either uniform white or uniform brown), and a uniform shape and size. After all the eggs of small size, poor color, and abnormal shape have been taken out, you will have two grades of first-class market eggs for which you should be able to obtain higher prices than the ordinary

market will pay. Egg dealers in New York City have been known to pay ten cents more a dozen for the large eggs than for medium-size eggs of the same color. They have also paid five to eighteen cents more a dozen for the uniformly white eggs than for mixed colors of the same size. The eggs that go into the cull grade may be sold for nearly market prices.

The best grade of eggs that you are producing for the wholesale trade should be packed in an ordinary thirty-dozen case if express shipments are to be made. You may be able to have some private customers in the city who look to you for their regular egg supply. This class of trade is not difficult to obtain if your eggs are of superior quality. The same grade should be sold each time to the same customer, so that he will become educated to appreciate superior grades in eggs. Consumers are usually glad to pay a premium for eggs of reliable quality. A little care and interest on your part will give you a profitable business all your own, which will afford some of the best profits and pleasures of farm life.

Remember the following: (1) Breed and grade your fowls so that they will lay eggs that are uniform in size, shape, and color, and of the quality that will best suit your customer; (2) gather the eggs daily; (3) carefully clean all soiled eggs; (4) sort the eggs into at least two grades; (5) neatly pack the firsts in cartons, or other attractive packages, which will command a considerable increase in price; (6) furnish your customer each time with a uniform grade of eggs; (7) up-to-date knowledge combined with attention to details, absolute honesty, and good business methods will bring success.

Cleaning eggs is a good occupation for children

ANIMAL STUDY

" 'Twixt bloom that blanches
The orchard branches
Old farms and ranches
Gleam in the gloam;
'Mid blossoms blowing,
Through fields for sowing,
The cows come lowing,
The cows come home.

"Where ways are narrow,
A vesper-sparrow
Flits like an arrow
Of living rhyme;
The red sun poises,
And farmyard noises
Mix with glad voices
Of milking-time."

From " Beech Blooms," by MADISON CAWEIN

LESSONS ON THE COW

I. THE DISTRIBUTION AND CARE OF COWS

E. S. SAVAGE

The cattle-bearing sections of the United States.—There are in the United States about fifteen millions of cows, both beef and dairy. The question naturally arises, in what States are they found? There are some cows in every State; but there are six States in the Union which deserve the title "The Six Great Dairy States," and five States which deserve the title "The Five Great Beef States." The great agricultural State of Iowa is found in both these lists, therefore it has the title "The Greatest Stock-Growing State." Texas, also, is found in both lists, but it does not stand so high as Iowa because of the vastness of its area.

Our own State of New York is the greatest dairy State in the Union, with 1,589,594 cows; Wisconsin has 1,437,505; Iowa, 1,406,792; Minnesota, 1,085,388; Illinois, 1,050,223; and Texas, 1,013,867. No other State has more than 1,000,000 dairy cows.

In numbers of beef cattle, Texas outranks the others by far, having 2,469,321 beef cattle. It must be remembered that the area of Texas is vast. Nebraska has 705,191 beef cattle; Iowa, 614,930; Kansas, 558,153; and Montana, 372,798. No other State in the Union has more than 200,000 beef cattle. Thus it is seen that, in this country, cattle are raised in largest numbers in the northern tier of States and in the Mississippi Valley.

Elgin, Illinois, is the greatest butter-market in the United States and the Elgin Board of Trade governs the price of butter in the Middle West. New York City is the greatest milk-consuming city in the United States. Chicago is the greatest market for beef cattle. Other great beef markets are Kansas City, St. Louis, and St. Joseph. Buffalo has a large beef-cattle market. Of course all the larger cities are great markets for raw milk and for beef in retail form.

Care of the dairy cow.— All cows deserve better treatment than they receive. They are entitled to the best of treatment, for they give us milk, butter, and cream while they live, and even when they die they give us shoes and robes and coats to keep us warm. Beef, the meat that they yield, is an important article of food.

A good cow is entitled to six things from her master: (1) kindness; (2) a clean, dry home; (3) plenty of light; (4) pure air; (5) pure water; and (6) an abundance of salt. Every caretaker of cows should see that these conditions are met, as well as that his cows have plenty to eat.

Every animal in a well-managed dairy herd will be so tame that the owner and attendants can easily catch her in the open lot at any time.

A dog, be he ever so gentle, is of little use in connection with a dairy herd. A club or a whip should have no place in a dairy barn.

Light and ventilation explain themselves. We must supply all the light and the pure air possible. It is not costly to provide light in a stable, neither is it very costly to provide efficient means of ventilation in old stables if the owner is a live, hustling manager with his mind open to the best in his power for the comfort of his animals. All the dairy papers and experiment stations are ready at any time to help and to suggest means of bettering stable conditions, with plans that may be had for the asking. Most of these plans are simple and economical, and farmers are fully capable of putting them into execution.

Cows should be watered at least twice a day. The water should be pure, and, if possible, it should be free from ice at all times of the year. If cows have a place to drink where ice does not form, and if they are watered twice a day, it does not seem necessary to warm the water artificially. It is important to avoid chilling the animal so that she will not have to stand and shiver after drinking. Any system is a " good watering-system " which will furnish pure water and which works so that the cow gets all that she requires at least twice in twenty-four hours.

A cow should be furnished with about one ounce of salt every day. The practice of our best dairymen varies. The writer would suggest feeding each cow about two ounces of salt three times a week, either mixing it in the grain feed or merely throwing it into the manger any time during the day.

If boys and girls, in helping their fathers to take care of the cows, will keep in mind the foregoing suggestions, our State will have not only the largest number of dairy cows, but also the finest, cleanest, and tamest cows in the world.

II. A STUDY OF COWS

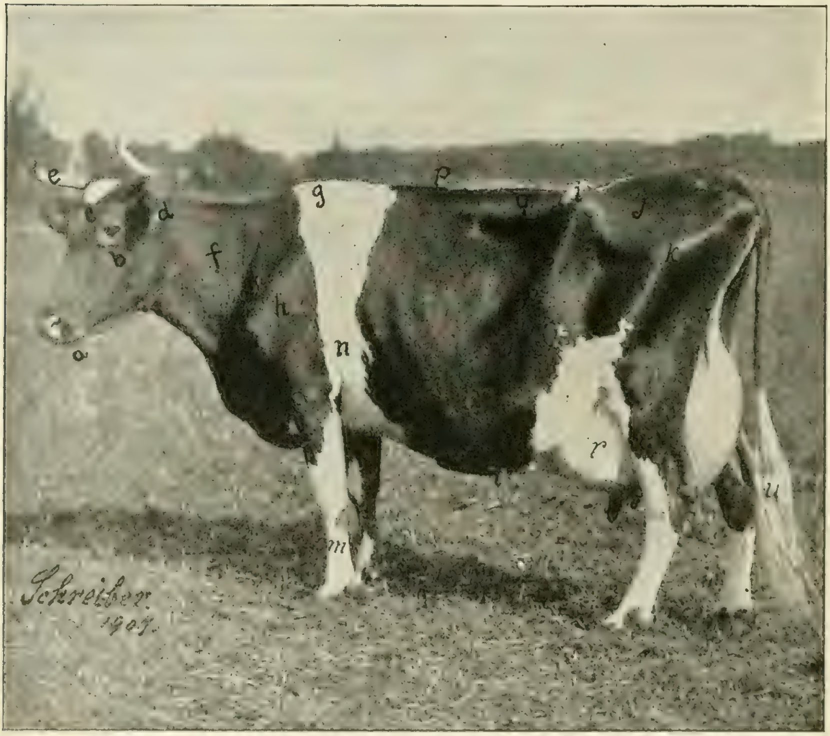
E. S. SAVAGE

Young folks in the State of New York should become more familiar with the animals of the farm. They should be taught to love farm animals; for cows can be loved and petted as well as dogs and horses, and a child's friendliness will be as fully appreciated by cows as by other animals.

Children in the schools can be taught to study animals at home and to report their observations at school. The teacher of a rural school should visit the homes of the children as much as possible and observe the animal life with the children. In this way parents will become more interested in the school work. In the hope of giving some suggestions to teachers, the writer has prepared the following topics and questions concerning the cow:

1. *The origin of cows.*
    a. What two rather distinct types of cows are there?
    b. In what countries are they found?
    c. From what countries have the cows in the United States come?

2. *The parts of the cow's body.*
    a. Where is the milk produced?
    b. What do the milk veins carry?
    c. Where are the withers?
    d. What is the " wedge shape " in the dairy cow?
    e. How does a cow kick as compared with a horse?



The parts of a cow: a, muzzle; b, eye; c, forehead; d, ear; e, horn; f, neck; g, withers; h, shoulder; i, hip; j, rump; k, thurl; l, thigh; m, leg; n, chest; o, abdomen; p, back; q, loin; r, udder; s, teats; t, milk vein; u, switch

3. *The teeth.*
    a. How many teeth has a cow? How many molars? How many incisors? On which jaw do the incisors grow?
    b. How does a cow bite?
    c. What other farm animal bites like the cow?

4. *Telling the age by the teeth.*
   a. How many incisors has the calf when it is born? When does the calf get all its "milk" incisors?
   b. When does the middle pair of permanent incisors appear? The next pair? The next pair? The outside pair?

5. *The digestion.*
   a. How many compartments has the stomach of a cow?
   b. What other farm animal has the same number of compartments in its stomach?
   c. How many times does the cow chew her food?
   d. Which is the true stomach?
   e. For what purpose are the first three stomachs?

6. *Food of the cow.*
   a. What foods are adapted to the needs of the cow?
   b. Why does a cow need succulent food at all seasons of the year?
   c. For convenience in studying the feeding of a cow, into what groups of nutrients do we divide her food?
   d. Can we divide the body of the cow into the same groups of materials?
   e. What is the interrelation of these materials in the food and in the body?
   f. How do we compute a ration?
   g. What is the nutritive ratio?

7. *Breeds of cows.*
   a. What are the four principal dairy breeds in America?
   b. What are the four principal beef breeds in America?
   c. In order of richness of milk, how do the dairy breeds stand?
   d. In order of prominence and favor in the United States, how do the beef breeds stand?
   e. What is New York, a dairy or a beef-producing State?

Answers to questions on cows

1. Prehistoric animals related to our cattle were domesticated by the Swiss Lake Dwellers. These cattle existed in rather large numbers down to historic times and were the ancestors of our domestic breeds of the present day. The two kinds of domestic cattle that exist to-day are our own cattle as we know them as separate breeds in Europe and America, and the humped zebu of the eastern countries of the globe. The humped zebu was domesticated in Egypt two thousand years before the Christian Era.

The cattle of the United States have come chiefly from England, Scotland, the Channel Islands (the islands of Jersey and Guernsey in the English Channel), and Holland. The beef breeds and all the dairy breeds except the Holstein-Friesian originated in England, Scotland, and the Channel Islands. The Holstein-Friesian cattle came from Holland. The man who may be called the father of all modern breeding and improvement of cattle was Robert Bakewell, who lived in England from 1725 to 1795.

2. The parts of the body of the cow are shown in the illustration on page 52 and require no further explanation. The udder and the milk veins make up the mammary organs of the cow. The milk veins do not carry milk. They drain the blood from the udder. The fresh blood from which the milk is manufactured is supplied to the udder from the heart through arteries and is drained away through the milk veins. The larger the milk veins, the larger the amount of blood probably flowing through the udder and the larger the milk production of the cow.

Age of cattle told by permanent incisors. The middle pair, marked 1, appears at eighteen months of age; the pair marked 2 appears at twenty-seven months; the pair marked 3 at thirty-six months; the outer pair, marked 4, appears at forty-five months

The wedge shape and the dairy shape are explained in the article in this leaflet on "The Beef Type and the Dairy Type," by H. H. Wing, page 1154.

The body of the cow is so made up that she can reach much farther forward when she kicks than can the horse. This enables her to protect her udder to a greater extent. A horse usually kicks straight out with both feet to protect himself.

3. A cow has thirty-two permanent teeth: twenty-four molars — twelve on each side, six above and six below — and eight incisors. The incisors are all on the lower jaw. The place of the incisors on the upper jaw is taken by a hard pad of cartilage against which the lower, chisel-like teeth strike when the animal crops the herbage in the pasture. The arrangement of the teeth of the sheep is the same as that of the cow. Sheep and cows can crop the grass closer to the ground than can horses.

4. A calf, when born, has two pairs of incisors. The other two pairs appear during the first month. When a calf is 18 months old he loses the middle pair of "milk" incisors and grows a permanent pair. The next pair, one on each side, is replaced at 27 months of age, the third pair at 36 months, and the fourth, or outside, pair at 45 months. The time of the appearance of these incisors varies within rather narrow limits, so that we are able to tell the age of young cattle fairly accurately. A

calf has also a temporary set of molars which are later replaced with permanent ones; but they are not considered in estimating the age of the animal.

5. The stomach of the cow and of the sheep has four compartments. The first three help in the storage and mechanical manipulation of the food. The fourth is the true stomach of these animals, in which that part of the digestion takes place which we ordinarily think of as taking place in a stomach.

A cow chews her food twice. The first compartment of her stomach is large and enables her to eat a large amount of food without stopping to masticate it thoroughly. This food is stored temporarily in the first compartment of her stomach. Later, at leisure, she can lie in the shade and re-chew all her food. After the second chewing, the food is swallowed and passes along to the true stomach and on into the intestines in the regular course of digestion.

6. Coarse foods are adapted to the requirements of the cow. A cow can consume large quantities of such coarse foods as hay, cornstalks, and the like. Under modern conditions, when cows are yielding large quantities of milk a large amount of grain also is fed. The grain is made up of ground cereals or of ground by-products from the manufacture of certain human foods.

Succulent foods are peculiarly adapted to the needs of the dairy cow. The best food is, of course, green pasture grass, the natural food of the cow. At all times of the year when pasture is not available, some succulent food, such as corn silage or roots, should be given. The cow will respond in every way to special care, such as providing a variety in her ration, with some succulent food when possible.

For convenience in studying in detail the feeding of a cow, we divide her food into five great groups of compounds: water, ash, protein, carbohydrates, and fat. Her food is almost entirely of vegetable origin, and the plants or the produce of plants that she eats are made up entirely of these groups of materials. The *water* in the plant is the same as any pure water with which we are familiar. It serves the plant in two important ways: by filling out the cells and thus helping in the support of the plant, and by transporting the food from the roots, or from wherever it is made, to those cells that need food. The *ash* of the plant is the mineral matter. The *protein* is the nitrogenous part of the plant tissue. The *carbohydrates* include the sugars and starches and like materials. The *fat* is the oil of the plant. All agricultural books use these terms, therefore the teacher should help the children to become familiar with them.

It is not easy to give common examples of the ash or of the protein of plants. These groups are intimately associated with the life of the plant and are present in all parts of it.

The plant may use any one or all three of the groups, protein, carbohydrates, and fat, as a form in which to store reserve food. Mainly, however, the common form in which reserve food is stored is in the form of carbohydrates, of which starch is the most common example.

The body of a cow is built up from the food that she eats. It is composed of the elements that also make up the plant body. These elements form numerous compounds, which may be grouped into the same five groups into which we separated the plant body or the food of the cow: water, ash, protein, carbohydrates, and fat. The chemical formula for an animal fat may not be the same as for the particular vegetable fat that was in her food; and this will hold true also for proteins and carbohydrates. In the animal body there are few compounds that are carbohydrate in nature. The plant, as noted above, stores its surplus food mainly as carbohydrate, with some protein and fat. The animal, on the other hand, stores its excess food material as fat. The proportion of protein in the animal body as a whole is large because the lean meat of the muscle tissue is nearly pure protein. A good example of animal protein is the albumen of an egg; another is the casein, or curd, of milk. We have no common animal carbohydrate. Lard and tallow are common forms of animal fat.

What data we have go to show that in order to form the protein of the body the animal must have protein in the food. Any excess of protein in the food that is not needed to form body protein will be broken up. A part of the protein carrying the nitrogen will be excreted and the remainder will be used as carbohydrate material. The protein of the body can have no source except in the protein of the food. The carbohydrate material in the body can have as its source, protein, carbohydrates, or fat in the food. The fat in the body may be manufactured from the protein, carbohydrates, or fat. Therefore, to summarize, there must be a sufficient amount of protein in the food in order to keep up the necessary protein of the body, but the fat or carbohydrates of the body may be derived from any one of the groups—protein, carbohydrates, or fat—in the food.

The animal uses the water that it drinks and that it derives from its food to keep up the supply in the body, much in the same way that the plant uses water to help support the body by keeping the cells distended, and as a transportation agent. The ash (mineral matter) taken into the body forms the bones and furnishes the mineral matter that is present in all the tissues. The protein makes up the muscle tissues of the body and any nitrogenous matter in the other tissues. The carbohydrates are used to furnish the energy for the muscles. Any excess of carbohydrates may be transformed into fat and stored as reserve material. Fats in the body are used to give energy to the cells, or they may be stored as body fat.

A cow or other animal has three uses for the food that it takes into its body: (1) to furnish energy for the mechanical work of the body; (2) to

repair any loss of material in the make-up of the body itself; (3) to store as fat any food material in excess of these needs. Fat and carbohydrates and excess protein over the protein requirements of the body, are used for energy and fat production. Some protein and ash are used for the repair work and for the new material added to the body in the case of the growing animal.

A ration is the amount of food that is fed to an animal in twenty-four hours for the above needs. The needs as to digestible protein, digestible carbohydrates, and digestible fat for our animals have been carefully calculated. Estimating the amount of food to meet these needs is called computing a balanced ration.

It has been found that there is a certain relation between the necessary amount of protein and of carbohydrates and fat in a ration. This relation has been called the nutritive ratio. The ratio is expressed between one pound of digestible protein and the necessary number of pounds of digestible carbohydrates and digestible fat. When the first term of the ratio is expressed as one, the second term is found by multiplying the fat by $2\frac{1}{4}$, adding to it the carbohydrates, and dividing this amount by the protein. The digestible fat is multiplied by $2\frac{1}{4}$ because fat is considered to yield to the body $2\frac{1}{4}$ times as much energy as carbohydrates.

For dairy cows, it has been found that a nutritive ratio between 1:5 and 1:6 seems to give the best results in milk flow.

To conclude: When we wish to compute a ration for a dairy cow weighing about one thousand pounds, we try to furnish suitable food in sufficient quantity to yield about twenty-four pounds of dry matter, in which the relation of the protein to the carbohydrates plus $2\frac{1}{4}$ times the fat is as 1:5 or 1:6.

7. The breeds of cows are mentioned in some detail in the article in this number of the leaflet on the colors of cows. In order of richness of milk, the dairy breeds rank as follows: Guernsey, Jersey, Ayrshire, and Holstein. The milk of the Guernsey and the Jersey tests 5 per cent to 6 per cent of butter-fat. The products of the Guernsey are a golden yellow; the products of the Jersey a somewhat lighter yellow, or cream color. The milk of the Ayrshire will average about 4 per cent of butter-fat, while the Holstein gives milk testing on the average about 3.5 per cent butter-fat.

The Shorthorn probably is held in higher favor in the United States than the other beef breeds, with the Hereford second; the Aberdeen-Angus stands third and the Galloway fourth.

New York is primarily a dairy State. Very little beef is raised in this State except, perhaps, in the western part. Most of the beef consumed is imported into the State from the great western markets.

In order to introduce the study of the cow successfully, the teacher should use every opportunity to become acquainted with the details of dairy work. There are excellent opportunities to use the dairy problems in the arithmetic and bookkeeping classes. Children who become interested in the business side of dairy farming will be a help and inspiration to their parents and will interest the parents in the school in a spirit of cooperation with the boys and girls and the teacher.

III. THE BEEF TYPE AND THE DAIRY TYPE

H. H. WING

Cattle are kept for two main purposes: for the production of milk and for the production of beef. These two purposes make quite differ-

The beef type

ent demands on the vital energies of the animal. For this reason, by selection through many generations of those animals, on the one hand, that are best developed for meat production, and of those, on the other hand, that give the largest amount of milk, there have arisen two types more or less distinct in form and in certain other characters, one known as the "beef" form or type, and the other known as the "milk" form or type.

It must not be supposed that these two types are entirely distinct or separate, for the cows of the beef type always give some milk, and animals of the dairy type will furnish beef of reasonably good quality when properly fattened. Then, too, while the types may be readily

recognized in the best-developed individuals of either, there are a great many animals of intermediate form that would be difficult to assign to either type, since the two types tend to merge into each other by very gradual gradations.

The chief differences in form that distinguish the beef and dairy types are:

1. In outline of body, especially as viewed from the side.
2. In depth and smoothness of flesh.
3. In size of udder and external blood vessels connected therewith.

In the beef form, the outline of the body approaches the rectangular.

The dairy type

The general direction of the top and bottom lines is straight and parallel, and the general dimensions of the body approximate those of a brick; that is, length twice the depth, and depth twice the thickness.

In the dairy type the general outline of the body is "wedge-shaped from before backward"; that is, the general direction of the top and bottom lines diverges from the front toward the rear. This is brought about by a relatively large development of the hind quarters and sometimes by relatively low and thin shoulders. The height of the animal at the hips is one half to one and one half inches greater than at the shoulders. The wedge-shaped appearance is increased by a large and pendulous abdomen and by a large and well-developed udder.

In the best beef animal, even when not fully fattened, the whole body is thickly and smoothly covered with flesh (muscle) so that the angles

of the bones are nowhere prominent. This is seen particularly over the upper part of the ribs immediately back of the shoulder, on the loins, in the thighs, and on the shoulder. The neck is short and blends smoothly into the shoulder and the whole body has a rounded appearance.

In the dairy animal, the lack of muscular development gives rise to a spare, angular appearance. The angles and joints of the bones are prominent, particularly in the pelvis and the spinous processes. This does not mean that the animal is poor or emaciated, for there may be abundant fat, as indicated by a soft, pliable skin, and by rolls of fat in the fold of the skin in the flanks, and still the animal may present this spare appearance.

In the dairy type, the udder is, of course, much larger and fuller than in the beef type, and the so-called " milk veins " stand out prominently on the abdomen, extending well forward to the chest. In the beef type, not only is the udder small and comparatively insignificant, but the exterior veins leading from it are small and more or less embedded in the surrounding muscular and fatty tissue.

IV. THE COLORS OF COWS

E. S. Savage

Pure-bred cows constitute only about 1.5 per cent of the cows raised in New York State. This number should be increased, for it costs no more to keep pure-bred animals than grade animals; and the profit from pure-bred animals is likely to be larger than that from grades. Furthermore, it is a great satisfaction to own a fine herd of pure-bred cows. Let us teach boys and girls to recognize the four leading dairy breeds of cattle and the four leading beef breeds. The lessons will give some interesting study in color and in markings, and the young persons will make a beginning on observation of cattle in the neighborhood.

The four great dairy breeds in New York State, in order of numbers of cows, are the Holstein-Friesian, called simply Holstein, the Jersey, the Guernsey, and the Ayrshire. The color of the pure-bred animals in each of these breeds is always the same within rather narrow limits. A pure-bred Jersey would never be mistaken for a Holstein or an Ayrshire, and very rarely indeed would she be mistaken for a Guernsey by any one with any real knowledge of the breeds.

This color characteristic is the one, perhaps, which is most surely transmitted from father and mother to offspring among pure-bred animals. Among grade animals, the color, in most cases, will be that of the breed of which the grade animal carries the most blood.

We may first discuss the color of each of the separate dairy breeds, and then of the leading beef breeds. One way to become familiar with

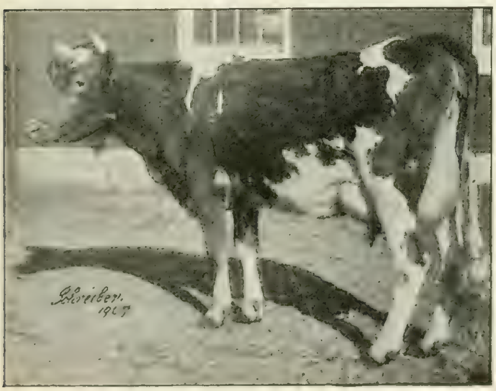
the different breeds of cattle is to see, as often as possible, copies of farm papers that give considerable attention to live-stock production.

A Jersey cow

The dairy breeds

The Jersey.— The color of the Jersey, in general, is solid fawn, varying through all the shades from light to dark, and becoming almost black in some cases. White is allowable and occurs in patches with sharply defined outlines in the general fawn color of the body. Jersey cows showing white are comparatively few in number. The photograph of the Jersey shown is that of a very light fawn-colored cow. A Jersey usually has a black nose, a black tongue, and a black switch, but these points are not required for eligibility to registration. The hair along the back and under the abdomen, and that immediately surrounding the muzzle and the eyes, is usually lighter than on other parts of the body. The skin should be a rich yellow.

The Guernsey.— The Guernsey cow is generally larger than the Jersey and perhaps a little coarser. The color is yellowish, brownish, or reddish fawn. This is wholly unlike the fawn of the Jersey, and is not likely to be mistaken after a few individuals of each of the breeds have been seen. The reddish fawn prevails. White markings are more common with Guernseys than with Jerseys. White occurs most often on the limbs and the under part of the body. The muzzle of the Guernsey is buff or flesh-colored, and is surrounded by a circle of light hair. The eyes are surrounded by the same kind of marking. The Guernsey cow usually has a white switch.



A Guernsey cow

The Guernsey is noted for the rich yellow color of the skin and of the secretions coming from the skin. There is supposed to be a relationship between this rich skin-color and the bright, rich yellow of Guernsey butter and cream.

A Holstein cow

The Holstein-Friesian.— The color of this breed is black and white. There is no variation in shade, the only variation among individuals being in the amount of each color. At various times in the history of the breed, more white has been popular than at other times. For example, at present a Holstein bull calf having more than fifty per cent white will bring a larger price than an equally good animal having less white.

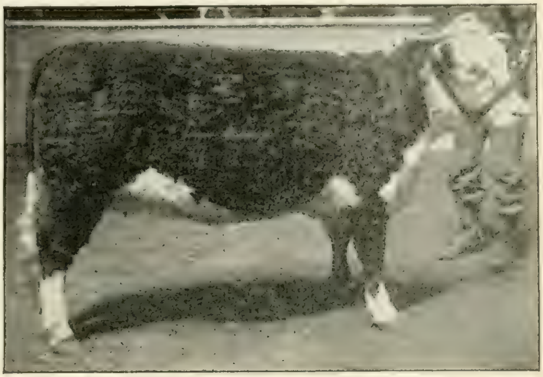
The Ayrshire.— The Ayrshire cow is red and white, although occasionally a brown and white animal may appear. In such cases, the brown always has a reddish tinge. As with Holsteins, a large proportion of white is popular. The color markings in the Ayrshire are not so regular as the black and white of the Holstein. Often a white Ayrshire cow will be flecked with red instead of being marked in large patches or in any regular way.

An Ayrshire cow

The best way to learn the different characteristics in color is to see animals of each breed. It is suggested to teachers that the children be encouraged to tell what kinds of cows they have at home and to describe the colors. Visits to good dairy herds in the vicinity of the school will increase the interest in the subject and give the children first-hand study of animal life. Farmers who are good dairymen are proud of their herds and are pleased to have them noticed.

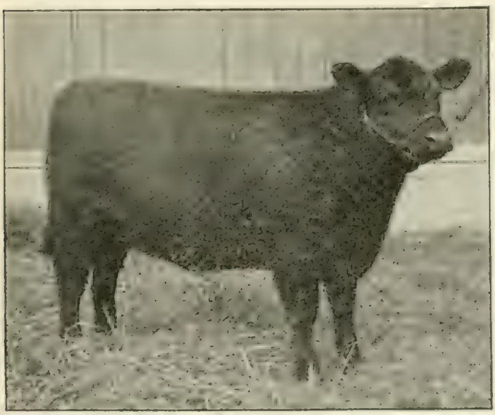
The beef breeds

There are comparatively few of the four great beef breeds — Shorthorn, Hereford, Galloway, and Aberdeen-Angus — in New York State, as this is primarily a dairy State. At one time Shorthorn cattle were in demand in New York, however, and in 1873 the highest price ever paid for a cow, $40,000, was paid for *8th Duchess of Geneva*, a Shorthorn. Beef cattle have given way to dairy cattle, and we do not find large herds of beef animals except in one or two places. The influence of the Shorthorn blood has been left in our grade and scrub herds, however, and we find many animals resembling Shorthorns. The grades of the other beef breeds are not nearly so numerous.



A Hereford cow

The Shorthorn.— The colors found among Shorthorn cattle are red and white in great diversity of proportions. We have wholly red animals and wholly white animals. Then there is found in large numbers the roan, a mixture of the red and white with the colors grading imperceptibly into each other through a mixture of the red and white hairs. In some cases the colors are distinct and the outlines of the patches of red are clearly defined. The picture shown on page 1154, in the lesson on "The Beef Type and the Dairy Type," is that of a roan Shorthorn cow with some parts of the body graded into clear white and other parts a clear red.



An Angus cow

The Hereford.— The characteristic color markings of the Hereford cow are her white face, white line on the back, white underline, white markings on the legs, and white switch. There is no definite extent prescribed for these colors,

but the face is always clear white and the outlines of the other white markings are distinct. The body is a solid dark red. The Hereford heifer shown in the above illustration well represents this breed.

A Galloway cow

The Aberdeen-Angus.— The Aberdeen-Angus cow is solid black and is distinguished from the Galloway by having shorter and straighter hair. The Angus cow is polled; that is, from birth she has no horns.

The Galloway.— The Galloway cow is also solid black with the best coat of hair of any of the breeds of cattle. The hair is rather long and wavy. The hide of the Galloway is especially prized for robes and fur coats. This is a polled breed, also.

The cows of the different breeds cannot always be distinguished by color alone. Other characteristics, which have not been mentioned, may need to be considered; but the color will enable us to determine the breed in the great majority of cases.

V. THE BABCOCK TEST FOR BUTTER-FAT IN MILK

R. A. PEARSON

Purpose.— To become familiar with a quick and accurate method of showing the richness of milk, which means its percentage of fat.

Materials.— A hand-power centrifugal tester, at least two milk test-bottles (Fig. 1), one pipette to measure the milk (Fig. 2), one acid measure (Fig. 3), one dairy thermometer, about one pint of sulfuric acid with specific gravity between 1.82 and 1.83, a few ounces of milk, and some hot water. All the necessary apparatus and acid can be purchased for about five dollars from any dairy supply company. They can be ordered through a hardware dealer. Sulfuric acid is sold also at drug stores.

Sampling the milk.— The milk to be tested should be thoroughly mixed just before the sample is taken, so as to make sure that the fat or cream is evenly distributed. This can best be done by gently pouring it back and forth between two vessels several times. The milk should be between 60° and 70° F.

Place the small end of the pipette at the center of the milk and suck the milk up above the 17.6-cc. mark. Quickly place the index finger over the upper end of the pipette, and by releasing the pressure allow the milk to run out until its upper surface is even with the 17.6-cc. mark when the pipette is held straight up and down.

FIG. 1.— *Test-bottle*

Place the point of the pipette a short distance into the neck of the test-bottle, holding it against the glass with both pipette and bottle at an angle (Fig. 4). Remove the finger so as to allow the milk to flow into the bottle. Be sure to get every drop of the milk, taking care to drain the pipette and to blow the last drop into the bottle. A little practice should make any one proficient with the pipette.

It is best always to make this test in duplicate; hence two bottles are needed for each lot of milk.

Using the acid.— The acid is very strong and must be handled with great care. If any gets on the hands, face, or clothing, it should be washed off quickly and water should always be ready for this purpose. *Do not leave the acid where children can get it.*

After all the samples of milk to be tested have been measured, the acid should be added. Fill the acid measure to the 17.5-cc. mark with acid that is between 60° and 70° F. Pour this into the bottle with the milk, holding the bottle in a slanting position. The acid will then carry down any milk left in the neck and will follow the glass surface to the bottom of the bottle and form a layer under the milk.

FIG. 2.— *Pipette, or milk measure*

Hold the bottle by the neck and give it a circular motion for a few minutes, mixing the milk and the acid until no milk nor clear acid is visible (Fig. 5). By this time the contents will be dark-colored and hot. This change is due to the acid dissolving all the solid constituents of the milk except the fat, which it does not affect.

FIG. 3.— *Acid measure*

Whirling the bottles.— The bottles are whirled in order to separate the fat so that it can be measured. They should be hot when whirled. If necessary they may be heated by standing in hot water before being put into the machine. A steam machine is easily kept hot when in use. Other kinds should have boiling-hot water placed in them.

Place the bottles in the machine so that each one will have another directly opposite, in order to keep the machine in balance. Whirl the bottles five minutes at the proper speed for the machine in use (Fig. 6). Then stop it and, with the pipette or other convenient means, add hot water to each bottle until the contents come up to the bottom of the neck. Whirl two minutes. Add enough hot water to bring the top of the fat nearly to the top of the graduations on the neck of the bottles. Whirl one minute. The fat should then form a clear column in the neck of the bottle.

FIG. 4.— *Mixing milk and acid. A rotary motion, with the bottle not pointed toward the face*

Reading the percentage.— Keep the fat warm so that it will be in a fluid condition. Hold the bottle by the upper end of the neck, letting it hang in a perpendicular position, on a level with the eye. Read the marks, or graduations, at the extreme top and bottom of the fat column. The difference between these is the percentage of fat in the milk. Some test-bottles are made to read as high as 10 per cent, while others read only to 8 per cent. Each percentage has its number marked on the glass, and on the 10-per-cent bottles there are five small spaces each representing .2 per cent between these principal marks. Thus, if the top of the fat column is even with the third short mark above the 7 mark, the top reading would be 7.6; and if the bottom is halfway between the first and second short marks above the 3 mark, the bottom reading would be 3.3; the difference is 4.3, which is the percentage of fat or the number of pounds of fat in 100 pounds of the milk tested. On the 8-per-cent bottles there are ten small spaces between each percentage mark, and each space represents one tenth of one per cent.

FIG. 5.— *Putting the milk into the test-bottle. The pipette is held at an angle with the test-bottle, with its point against the inside of the neck*

FIG. 6.—*Whirling the samples*

Notes

One cc. means 1 cubic centimeter, or about 20 drops.

If the fat column is clouded with white specks, probably the acid was not strong enough, or not enough was used, or the heat was not high enough.

If the fat column is clouded with dark specks, probably the acid was too strong, or too much was used, or the heat was too great.

Always keep the acid bottle closed when not in use or the acid will lose strength. *Remember that it is a poison and corrosive.*

POINTS TO BE ESPECIALLY NOTED IN MAKING THE BABCOCK TEST

H. E. Ross

1. Be sure to mix the sample of milk thoroughly before drawing it out with the pipette.

2. When measuring a sample of milk with the pipette keep the index finger dry.

3. When measuring a sample of milk keep the mark on the pipette on a level with the eye. The same precaution should be observed when reading the percentage of fat after the test is completed.

4. Do not try to measure a sample of milk by drawing the milk just to the mark on the pipette. Draw the milk *above the mark*, as directed.

5. When adding milk or acid to the test-bottle, slant the bottle. The liquid will then run down the lower inside of the neck of the bottle, and will not be forced out by outcoming air.

6. Do not hold the bottle so that its mouth points toward yourself or any one else. The action of the acid on the milk produces great heat. This heat often causes the contents of the bottle to spurt out violently.

7. After adding the acid to the milk, shake the bottle thoroughly until the contents become dark in color.

8. After using the pipette wash it thoroughly, preferably in hot water. This will tend to prevent the transmission of disease germs from the mouth of one person to another, should any such germs be present.

9. The tester should be firmly fastened to a solid bench or table.

10. The person operating the machine should give his or her whole attention to it, and not allow the fingers or clothing to get in the path of the bottle cups.

11. Remove all objects from the vicinity of the tester. This will prevent their being hit by the bottle cups when the machine is in motion.

12. If acid is spilled use *plenty* of water, and then add an alkali, such as lime or baking soda, in order to neutralize the acid.

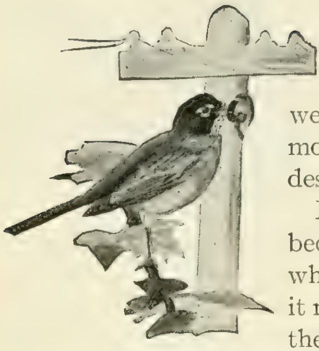
13. Do not leave the acid bottle uncorked.

14. Keep all glassware perfectly clean.

15. After washing the glassware, rinse it thoroughly in clean water so as to remove soap powder. The soap powder and the acid form a violent chemical reaction.

THE EARTHWORM

ANNA BOTSFORD COMSTOCK



THE earthworm is a creature without eyes, with no sense of smell nor organs of hearing, and with no legs nor arms; but the more we study it, the less sorry we are for it and the more we admire the way in which it succeeds despite its natural drawbacks.

First of all, the earthworm does not need eyes because it lives below the surface of the soil, where eyes would be of little use. Neither does it need a sense of smell, because it has to swallow the soil wherever it lives and whatever the odor. Although it has no organs for hearing, it is very sensitive to vibration; this sense is so keen that it knows by the jar of the robin's feet when hopping over the ground that this enemy is approaching, and it squirms down out of reach as rapidly as possible. Neither does it need legs, for these would be in the way. Its method of locomotion is most excellent for a burrower: on the underside of its body there is on each of the segments, except the first three and the last, a double row of bristles, which project backward — that is, in an opposite direction from that in which the worm is moving. By stretching out these elastic segments and catching hold of the soil by these bristly hooks, and then contracting the segments, the worm moves fast enough for all its needs.

It would seem at first sight that the earthworm would be very wise indeed if it knew at which end of its body was its head; but the earthworm is not likely to make a mistake in this respect so readily as are we. In fact, it knows much more than we could believe possible of such a lowly creature.

The earthworm has a rather remarkable mouth: the upper lip is extended into a proboscis and is used as an elephant uses his proboscis — for pushing food into the mouth. Inside the mouth is a pharynx, which can be extended or withdrawn; it acts as a suction pump in drawing the food. The earthworm has no teeth but it manages to eat through the hardest soil. If we bring one into the schoolroom and place it on cabbage or lettuce leaves we can see how it eats.

The earthworm makes for itself a very comfortable burrow, which, opening at the surface of the ground, goes straight down for a distance, then winds about irregularly, and is usually enlarged at the farther end so as to make winter accommodations for several of the worms. The burrow has to be large enough so that anywhere in it the worm can turn around.

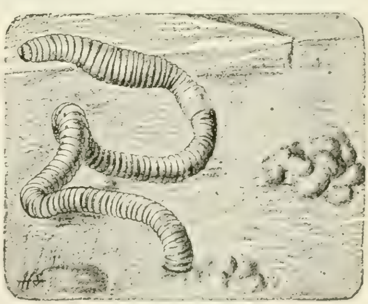
In plugging the mouth of its burrow the earthworm shows much intelligence. When it draws in a triangular leaf it usually seizes the leaf by the apex, never drawing it in by the petiole unless the base is narrower than the apex. When drawing in pine needles it always takes hold of the base, where the needles are jointed.

It is as an agriculturist that we are chiefly interested in the earthworm. Into the earth, sometimes as far as seven or eight feet but usually for twelve to eighteen inches, goes this little tiller of the soil, bringing to the surface the subsoil. The worm breaks up hard soil by grinding it in a gizzard stocked with grains of sand or fine gravel, which act like millstones. The soil that passes through the earthworm's body is thus of a much finer texture than we can produce by raking or harrowing, and to it has also been added lime from the creature's body. Earthworms plant seeds by covering those that lie on the ground with soil from below the surface, and they further benefit growing plants by keeping the soil fine and granular about the roots. Darwin has estimated that in the garden soil in England there are as many as fifty thousand earthworms in an acre, and that the whole superficial layer of vegetable mold passes through their bodies in the course of every few years at the rate of eighteen tons per acre yearly.

This agricultural work of the earthworm has been going on for ages. Rocks have been undermined and the aspect of the landscape has been greatly changed. Several Roman villas in England owe their preservation to this little creature.

The number of segments of its body varies with the age of the earthworm. When the worm is fully grown there is a thick, whitish ring near the end.

The laying of the earthworm's eggs is an interesting performance. A sac-like ring is formed about the body in the front, near the whitish ring just mentioned. This little girdle is gradually worked forward, and as it goes over the head the sac ends snap together enclosing the eggs. These capsules, yellow brown, shaped like a football, and about the size of a grain of wheat, may be found in the summer in or about manure piles and under stones.



The earthworm

LESSON FOR THE PUPILS

Method.— The pupils should be impressed with the fact that the earthworm is a creature of the soil and is of much economic importance. It is well to have a terrarium in the schoolroom filled with damp earth. Scatter grass or leaves on top of the

soil, put in some earthworms, and let the children see what happens. The soil should be kept moist, for without water the earthworms soon dry up.

Observations.— 1. Describe how the earthworm crawls. Does it turn over? Compare its movements with those of a snake.

2. Compare the length of the earthworm's body when extended and when contracted. Of what use is this contractile power?

3. Describe the home of the earthworm. Watch the earthworm make a burrow and note how long it takes the worm to disappear in the earth.

4. In what kind of soil do you find earthworms at work?

5. What is the food of the earthworm? How does it get its food?

6. Write an English theme on the use of the earthworm to farmers.

SHEEP

E. S. SAVAGE

Zoologists are not agreed as to the exact origin of the native sheep. Whatever their origin, all members of the wild-sheep tribes are mountain- and highland-loving animals. Our domestic sheep have inherited this peculiarity, preferring cool climates and highlands and open ranges, quickly suffering when closely housed for any length of time.

Our common sheep is a good illustration of the influence of domestication. The modern animal has few characters that would indicate its descent from wild species. Sheep have been under subjection by man from the earliest times. Abraham's wealth was measured by his sheep, oxen, and camels. From the fact that sheep have so long been under domestication in many different countries, it naturally arises that we have many different breeds for different climates, uses, and conditions of environment. The breeds of modern sheep are classified according to their uses, whether for the production of wool or of meat.

The sheep belongs to that large order of quadrupeds known as the *Ruminantia* for the reason that they are all ruminating or cud-chewing animals. They have incisors—or front teeth — on the lower jaw only, four stomachs, and cloven hoofs. The incisors on the upper jaw are wanting, being replaced by a hard, tough pad against which the lower front teeth are shut, thus cutting off the grass.

In order to better understand the care, management, and feeding of sheep, it is well to have at least a partial knowledge of the organs of nutrition. The first of these organs are the teeth. They are truly organs of digestion in that they sever the food from its roots when the sheep is grazing, and serve to grind it up and mix it with saliva. This saliva is secreted in the mouth, and aids in digestion.

Sheep have two sets of teeth; first, a temporary set, called the deciduous teeth, meaning those that fall out; and later, a permanent set. We will study in detail the incisors, or front teeth, only. The temporary incisors come into the mouth within three weeks after birth, and are eight in number. At the end of thirteen to fifteen months after birth, the middle pair of these temporary incisors will have been replaced by a pair of permanent incisors; at the end of two years or a little more, the next two — called the inner middles — will be in place; and then in another year and a half, the last two permanent incisors will have come in, and

Middle wool sheep in England

the sheep will be four and one half to five years of age. The molars, or grinders, or back teeth as they are called, come in somewhat regular order, filling the back parts of the jaws in about the same time; all the molars being in place and all in wear at the end of five years.

The lips of the sheep are peculiar in their construction and take an important part in the gathering of the food. The upper lip has no muzzle such as is seen on cattle (the broad patch on the upper lip which is provided with an excretory apparatus, and which we may recognize by the beads of perspiration that stand on a cow's upper lip in hot weather). Instead, the sheep's upper lip is divided in the middle by a fissure, which allows either part to be moved independently. This construction of

teeth and lips, coupled with the small size of the animal, enables sheep to graze land much more closely than can cattle.

After the food has been partly masticated it passes down through the gullet, or esophagus, into the first of the four stomachs, called the rumen. If we remember the order to which sheep belong, *Ruminantia*, we shall have no trouble in remembering the name of the first stomach. Here the food is somewhat softened by the warmth and moisture, and is formed into long pellets. Later, when the sheep "chews its cud" these are forced back into the gullet and thence into the mouth. There they are thoroughly masticated and reswallowed. This time the food does not stop at the opening into the rumen, but passes on into the third stomach. The opening into the rumen from the esophageal canal is merely a slit, which probably opens and closes automatically and does not respond to the food after its remastication. The food, on its way to the third stomach, passes the opening into the second stomach, or reticulum. The reticulum serves as an aid to the rumen. It is usually full of liquid, and may serve as a storage place for water for immediate use, much as in the well-known case of the camel.

The third stomach is known as the omasum, or, commonly, the "many-plies," because of the large number of "leaves" that make up its lining. Here the food gets its final squeezing and grinding, until it is sufficiently worked over and disintegrated to be acted on by the gastric juice of the fourth stomach.

This last compartment is the true stomach, corresponding to the single stomach in the horse or in man. It is called the abomasum. Here the gastric juice is formed and true digestion takes place. The food now receives its final disintegration and the nutritive parts are dissolved, ready to be absorbed by the villi of the intestines.

The intestines are made up of a long tube which is doubled many times upon itself. The internal coat of these organs is covered with thousands of minute absorbent vessels called villi. This coat is a network of blood-vessels and so-called lacteals, resembling the close pile of velvet. The food passes through these organs where the villi pick out the nutritive part and pass it into the blood; the blood takes the nutriment to those parts of the body in which it is most needed.

From the above facts we see that the construction of the digestive tract is not only interesting to the shepherd but instructive also. He should have as thorough knowledge of this construction as possible, for it is in these parts of the body of the sheep that most of the mishaps and ordinary diseases arise.

It would seem that these peculiar organs must have been designed especially for these shy creatures, which seen to have little or no means

of defense and which seem to be legitimate prey of larger and fiercer animals. With its large pouch for carrying undigested food, the sheep can graze at night or at short intervals during the day, then retire to its coverts and chew and digest at its leisure.

Sheep do not seem to have an over-abundance of intelligence and are shy, weak creatures. Therefore they should be handled carefully and easily. The flocking habit is very strong with them and is one of the habits which help in their management on the large open ranges. With the aid of dogs, large flocks can be easily worked from place to place, the dogs guiding the flocks and keeping the stragglers hemmed in.

Sheep are excellent grazers, and the grazing habits of their early ancestors are still to be clearly seen in the domestic strains. They still prefer the highlands and open places, although in some countries the different breeds have been accustomed to different kinds of country so that we now have breeds that develop and grow well on lowlands, Sheep are accustomed from their origin to eat herbage of greater variety than do cattle; hence by taking advantage of this habit we can use them to clean up weedy and run-out farms and graze down coarse lands on which cattle cannot thrive.

WEASELS

A. H. WRIGHT

The *small brown weasels*, or Bonaparte's weasels, are dark brown above and white on the underparts in summer, with a black tip to the rather short tail. The winter coat is white except for the terminal third of the tail, which remains black. There is a difference in size between the males and the females, the former being $11\frac{1}{2}$ inches in length, the latter only 10 inches. Their food consists mostly of mice, moles, shrews, small birds and birds' eggs, and insects, chiefly beetles. They have never been known to attack poultry or the larger mammals. In character they are inquisitive and not especially wary. They allow a person to approach within a few feet before they run for shelter, but if a person makes a squeaking noise they will stick their heads out of some hole or opening so as to investigate. They are ever on the alert and disappear instantly if their suspicions are aroused. Their nest of leaves and herbage is warm and dry, and is usually placed in some hole in a bank, dry ditch, or hollow tree. There are four to five young in a litter, and two or three broods a season.

The *New York weasels* are larger than the small brown weasels and are often known as " ermine," In length the males are 16 inches, the females 13 inches. Like the smaller weasel, they are dark chocolate-brown above and white underneath. They become white in winter except for the black tip of the tail. The black tip is longer in these weasels, and the tail is also longer in proportion. They have a well-developed scent gland.

Ermine are disagreeable neighbors for the farmer, as they kill for the mere joy of killing, often leaving victims uneaten as they hurry on for more. These tireless hunters follow their prey by scent, and, whenever there is an abundance of game, content themselves with merely sucking the blood or biting into the skull and devouring the brain. In cold weather, however, they often store the uneaten food. They go on long hunts which sometimes last for weeks, and they seek shelter in the several nests that they have along the route. They kill many mice, rats, chipmunks, and squirrels, chasing them long distances over land or through water. They follow them into any retreat, and frequently seize their prey by the throat. They are fond of ruffed grouse and are very destructive to our domestic fowls, having been known to kill as many as forty in one night. Their white color doubtless protects them in their winter hunting, and the black tip of the tails, holding the attention, distracts from their form as they leap over the ground in their peculiar way. The footprints are in twos, considerably larger than those of a mouse, the hind feet falling exactly in the prints of the fore feet.

The homes of these troublesome animals are under stumps, in hollow roots of old trees, or often in burrows formerly the property of some animal eaten by the weasel. Little is known of their breeding habits, but during the greater part of the year the two sexes are not congenial. There is probably but one litter in a year, numbering five to six young. These are born in early May and remain near the nest during the summer.

SNAILS

A. H. WRIGHT

FIG. 1

The common snails are interesting forms of animal life for schoolroom observation. The pond snails will be found on the vegetation around the sides of a pond or on leaves taken from the bottom. They may be kept in any glass jar filled with water in which there are some aquatic plants, including the green slime found on the surface of ponds. The land snails are plentiful in all limestone regions and can be found in any rather moist place, under the shelter of loose stones or boulders, or under dead leaves or decaying logs. Some live on leaves or grasses, sedges or shrubbery, particularly near ponds.

The food of all snails consists mostly of the tender parts of some form of plant life, such as leaves of plants. They feed on the algæ, which appear as the green slime mentioned above. Snails are most active in the spring,

reaching their greatest growth by midsummer. Normally they live but one or two years. In winter they bury themselves in the ground and close their shells with a leathery secretion of mucus. The naked slugs also cover themselves with this secretion.

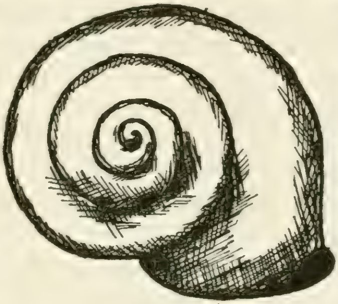


FIG. 2

Two types of shells will be found among the land snails, conical, or turreted, shells (Fig. 1) and orb shells (Fig. 2). The latter are nearly flat and are circular, although spirally formed. When startled or inactive, snails withdraw their whole bodies into their shells. The clear, jelly-like masses of their eggs are found under leaves or other vegetation in moist places.

The common slug, often found under boards in our gardens, looks like a snail that has lost its shell; but close observation shows that there is a small, shell-like scale on its back. This scale covers and protects the lungs of the slug. The garden slugs are a great nuisance, as they destroy so many plants, eating out the heart of celery or the center of a head of lettuce. They may be kept from a small area by surrounding it with ashes, which form a barrier that snails cannot cross.

FIG. 3

FIG. 4

Three types of pond snails are easily found—those with orb shells, those with conical shells spirally wound to the left (Fig. 3), and those spirally wound to the right (Fig. 1). Watching these snails as they

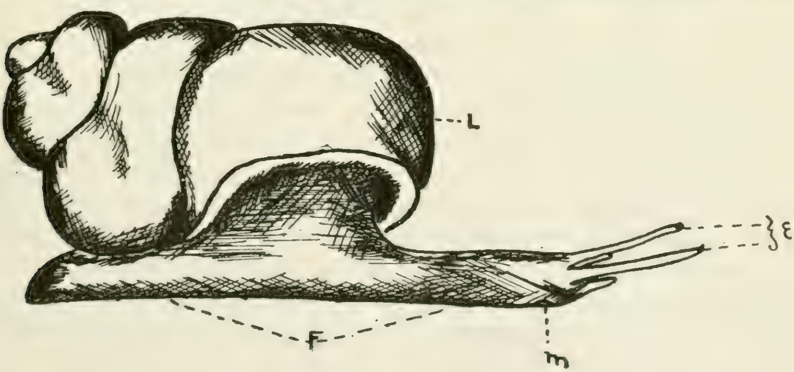


FIG. 5

travel over the glass sides of an aquarium, one can see them eat the minute green algæ growing there. The horny lingual ribbon, with its

fine, scraping teeth (Fig. 4), can be seen in motion. Some of the snails look very strange as they walk along the underside of the surface film of the water. Their eggs are deposited in clear, jelly-like, almost transparent packets, each containing one hundred to one hundred and fifty eggs. In an aquarium these eggs are frequently attached to the glass sides, but in the pond they will be found attached to stems or the undersides of leaves.

The part of the snail which protrudes from the shell and by means of which it moves about is known as the "foot." The eyes are borne on the ends of long tentacles on the forward end of this "foot." If disturbed these eyes disappear in the inside of the tentacle. Snails have also two shorter tentacles which aid them in their searches. All air-breathing snails have lungs within the mantle that lines the body chamber of the shell. In snails in an aquarium the edge of the mantle can be seen to rise at one point from time to time and release a "bubble of air." (Fig. 5).

RABBITS

ANNA BOTSFORD COMSTOCK

In the northeastern United States there is only one common species of rabbit, and that is the gray rabbit, or cottontail. The varying hare, or white rabbit, which was common here fifty years ago, has become practically exterminated. This was one of the most interesting of the species because it changed its coat to white in the winter.

The two most noticeable features in the general appearance of a rabbit are its long ears and its long hind legs. These two characters are closely connected: the long ears are always on the move to catch any sound of danger, and as soon as this is heard its direction is determined; then the long hind legs are used to help the little creature go in the other direction in mighty leaps. The constantly moving nose probably also has to do with sniffing danger, for it is only through sure flight that these little animals may escape from the many enemies which surround them. The rabbits are peculiar also in that the bottoms of their feet are hairy. The front feet cannot be used to hold food to the mouth as is true of squirrels and mice, but this is not needed as the rabbit eats on the ground.

The cottontail does not dig a burrow, but sometimes occupies the deserted burrow of a woodchuck or a skunk. Its nest is called a form, which merely means a place beneath a cover of grass or briars, where the grass is beaten down or eaten out for a space large enough for the animal to sit in. The mother makes a soft bed for the young, using grass and her own hair for the purpose; and she constructs a coarse, felted coverlet, under which she tucks her babies with care every time she leaves them. When they are about three weeks old they can run rapidly.

Rabbits have two long gnawing teeth in the front of each jaw. The remaining teeth are broad grinders in the back of the mouth. All rodents except the rabbit have no teeth between the gnawing teeth and the grinding teeth, but rabbits have a small pair of teeth arranged one on each side of the upper long ones. These are left-overs from rabbit ancestors which evidently had four gnawing teeth on each jaw. It is with the front gnawing teeth that the rabbit hurts young trees by girdling them in winter when driven by starvation to feed on the bark. The cleft in the upper lip leaves the gnawing teeth free.

The varieties of rabbits and hares found under domestication are: *Belgian Hare*, fawn to red-brown in color, medium size, long and graceful; bred for the market. *Common rabbit*, which may be white (albino), black, maltese, or with broken colors. *Angora*, white or broken-colored; a small to medium breed, with short ears and silky hair; a purely fancy breed. *Lop-eared*, fawn to brown in color; very large ears, which droop; a fancy breed; very tender, requiring artificial heat in winter. *Himalayan*, a small to medium breed; white, with black ears, nose, and feet; short hair; alert and active; a very fancy breed. *Flemish Giant*, very large, weighing fourteen to eighteen pounds; fawn to brown in color; seldom raised.

VIRGINIA DEER

A. H. Wright

Virginia deer are about six feet in length and stand three feet high. Their general color in summer is bright rufous chestnut, with a dark band on the chin and throat; the belly, the underside of the legs, and the underside of the tail are white. The winter covering is coarse and is tinged with gray, or may be very bluish in early fall. The coat is shed twice a year, in June and September. The change is gradual and does not affect all the parts at once. The antlers, possessed only by the buck, are about 21 inches in length and $4\frac{3}{4}$ inches in circumference at the base. They curve outward and upward, the tips turning in toward each other. A short, upright spike is given off near the base, beyond which the beam develops two upright branches, making three nearly equal prongs. In battle the animals approach with bowed heads and the tines meet, shielding each animal from the points of the other. Sometimes the antlers interlock so that the animals cannot separate and as a result may starve. The growth of an antler is very rapid. Starting as a mere button-like growth in the middle of May, it attains its full size by September. It is covered with "velvet," which carries a blood supply until the buck is full grown, when he rubs the velvet off by scraping his horns on bushes and rock ledges.

Virginia deer do not migrate and they have a very small home range. Ordinarily they have a low, smooth, bounding gait, with an occasional high jump. Their footprints are arranged alternately in a double row. The hind foot falls exactly in the mark of the fore foot, which makes an impression about $5\frac{1}{2}$ inches in length. The two parts of the hoof are very sharply defined and are often unequal in size. Deer are good swimmers.

These animals do not make a nest. The young are born in the middle of May, usually two fawns at a time. The mother hides them in some sheltering underbrush, whither she comes to nurse them. The coat of the young is a rich bay, with clear white spots, which coloring is lost after about four months. These little animals are exceedingly graceful. The males follow the mother for one year, the females for two years. They have many enemies, including bears, wolves, panthers, lynxes, foxes, and eagles.

In summer, deer follow the water courses, and they feed on herbs, grasses, marsh or aquatic plants, leaves of deciduous trees and shrubs, berries and fruits whenever within reach, and as many beechnuts as can be found. As winter approaches they gather in bands, and when the weather grows severe they congregate in a "yard," which is a cleared, stamped-out space with a wall of snow about it. Here their food consists of buds, low deciduous trees, twigs and foliage of arbor vitæ, hemlock, and balsam, and a few mosses and lichens.

Deer can be readily semi-domesticated for park purposes, but they are treacherous and dangerous as pets.

Virginia deer

INSECT STUDY

MOSQUITOES*

Glenn W. Herrick

Within very recent years perfectly satisfactory proof has been given that some species of mosquitoes carry the germs of certain diseases from one person to another. For example, certain mosquitoes, known as *Anopheles*, carry the germs of malaria from one individual to another. Moreover, another species of mosquitoes, which occurs in the warmer parts of the earth, inoculates persons with yellow fever. In fact, we have come to believe that the only way in which these two diseases are spread from one person to another is through the bites of these tiny insects. Since these discoveries were made, the hum of a mosquito has come to have an entirely new meaning to us. Hitherto our only thought was to kill the insect in order to prevent its annoying us; now we see visions of sick-beds, feverish patients, suffering, and, in many cases, death. Naturally, a great deal of interest in mosquitoes has been aroused.

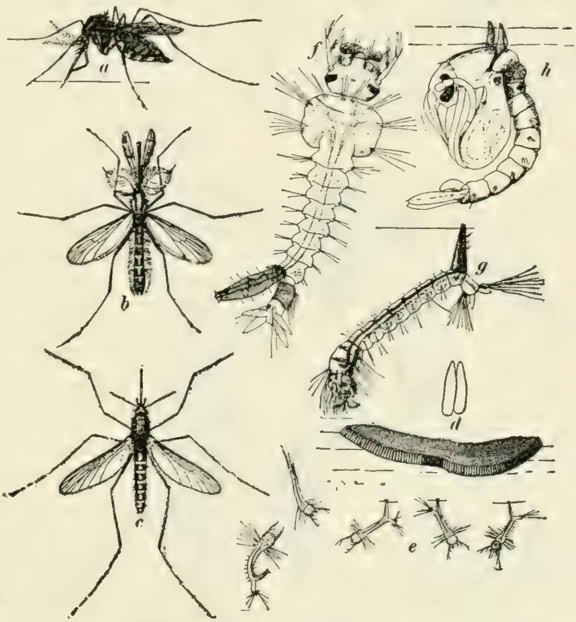


FIG. 1.—*Life story of a Culex mosquito: (a) and (c) females; (b) male; (d) eggs; (e) young "wigglers"; (f) full-grown larva, or "wiggler"; (g) larva in feeding position at surface of water; (h) pupa. All enlarged. (Adapted from Howard)*

There are many different kinds of mosquitoes in New York State, but not over a half dozen of them are at all common about our houses and only one of them is positively known to carry all the different types of malaria. This one, however, seems to occur everywhere in New York State in sufficient numbers to carry malaria to many persons.

Life history of a common mosquito.— The common house mosquito, *Culex*, lays its eggs in boat-shaped masses (Fig. 1,d) on the surface of

* Mosquitoes are sucking insects.

the water in rain barrels, tin cans, ponds, streams, pools — in fact, on the surface of almost any standing body of water, large or small. The masses of eggs are dark brown and look like specks of soot floating on the water. In twenty-four hours to a week, depending on the temperature, the lower end of each egg breaks open and a tiny wriggler — commonly called "wiggler" — or larval mosquito, (Fig. 1, e and f) comes forth into the water. These wrigglers are very active and some of them are constantly wriggling up and down in the water in search of food. When not in motion they rest quietly just beneath the surface, with a long tube on the end of the body projecting a trifle out of the water. It is through this tube that the tiny wrigglers draw in a supply of air and keep themselves from drowning (Fig. 1, g). The body hangs head downward at an angle of about 45 degrees (Fig. 1, g). The wrigglers live in the water for one to three weeks, depending on the temperature and the amount of food. At the end of this time each one changes to what is known as a pupa (Fig. 1, h). The pupa appears to have a large head and a slender tail, and can also wriggle about in the water. It lies quietly, when not disturbed, just at the surface. In four or five days the skin of the pupa breaks open along the back and the full-grown mosquito crawls out. After drying its wings for a few minutes it flies away in search of some animal from which to suck blood. In the fall the full-grown mosquitoes hide in dark cellars, stables, and other places, where they rest quietly until the following spring.

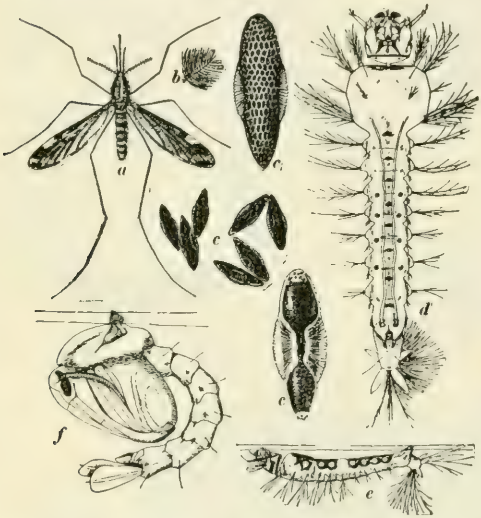


FIG. 2.— *Life story of an Anopheles mosquito: (a) female; (b) antenna of male; (c) eggs; (d) larva, or "wiggler"; (e) larva in feeding position at surface of water; (f) pupa. All enlarged. (Adapted from Howard)*

Life history of a malarial mosquito. — The *Anopheles*, or malarial mosquito, lays its eggs on the surface of standing water also; but each egg is laid separately, so that the eggs are not in masses glued together although several may be close together on the surface and lie there touching one another. The eggs hatch into wrigglers, but the wrigglers of *Anopheles* lie in a horizontal position just beneath the surface of the water (Fig. 2, e).

Moreover, when they move they usually wriggle sidewise just under the surface of the water, although they may dive down toward the bottom. The wrigglers live about two weeks and then change to pupæ, which resemble those of *Culex*. The full-grown mosquitoes soon appear, thus completing the life cycle in about three weeks.

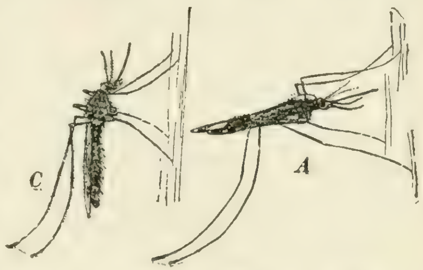


FIG. 3.— *Resting positions of Culex (C) and Anopheles (A) mosquitoes. Enlarged. (Reduced from Howard)*

The *Anopheles* is not so much of a house mosquito as is the *Culex*. The *Anopheles* wrigglers breed farther from the house, along the quiet margins of brooks, ponds, and pools, among the grass and sedges, and in other similar situations. The full-grown mosquito evidently flies a considerable distance, for it seems to find its way easily into our houses. It is thought, however, that the malarial mosquitoes will not ordinarily fly more than five or six hundred yards.

Differences between Culex and Anopheles mosquitoes.— It is only the female mosquitoes that bite. The male mosquitoes are harmless. They may be known by the hairy appendages borne on the head; the female mosquito does not have these long hairs on the head (Fig. 1, c).

The female *Culex* has one long, straight projection from the head, the beak; while the female *Anopheles* has three straight projections from the head, the middle one of which is the beak. The wings of the female *Anopheles* are mottled with dark spots, whereas the wings of *Culex* are plain and clear. When *Culex* rests on the wall the body is held parallel with the surface, but *Anopheles* usually rests with the hind end of the body tipped up at an angle to the surface. (Fig. 3.)

There is also the difference between the wrigglers of *Culex* and *Anopheles* which has already been pointed out, namely, the difference in position which the wrigglers of these two mosquitoes occupy in the water.

The yellow fever mosquito.— The mosquito that carries yellow fever is found only in the warmer countries of the earth. In the United States it occurs in the Southern States at least as far north as Virginia. In past years there have been epidemics of yellow fever in New York City and in Philadelphia, and it would therefore seem that this mosquito must have occurred as far north as New York.

The yellow fever mosquito is really very pretty. The legs, thorax, and abdomen are banded with conspicuous silver stripes. The wrigglers are found about houses in rain barrels, tanks, and the like.

The beak and the bite of a mosquito.— All mosquitoes are sucking insects. Each one has a long proboscis, or beak, projecting from the front of the

head. Inside the beak are six slender, needle-like organs with which the hole is drilled into the flesh of the person bitten; and the same slender stylets serve as a sort of tube through which the blood is sucked up into the mouth.

Within the head of a mosquito there is a sac or gland containing a fluid that acts like a poison on the blood of a human being. When the mosquito sucks blood, it injects a drop of poison from this sac into the wound. As a result there is much irritation and sometimes pain from a mosquito bite, due to the presence of this poison in the wound. The irritation from a mosquito bite varies greatly with different persons. With some persons there is scarcely any burning or itching, while with others swelling and inflammation occur, accompanied by severe pain.

Methods of controlling mosquitoes.— The best way to get rid of mosquitoes is to drain or fill up the ponds and pools in which they breed. Old tin cans, pails, and the like, containing water, should be turned bottom side up or drawn far away from houses. Rain barrels and tanks may be covered with wire netting in order to prevent the mosquitoes from laying their eggs on the water.

In many cases ponds and pools that cannot be drained may be sprinkled with kerosene oil every two weeks during the summer. The oil spreads over the water in a thin film and prevents the wrigglers from obtaining air through their breathing tubes. They are consequently drowned. Moreover, the oil kills the eggs and prevents the female mosquitoes from depositing more. In those pools and tanks that cannot be drained or that it is not desirable to cover with oil, certain fishes may be introduced which will destroy the wrigglers. Goldfish, sunfish, and certain minnows will serve to keep pools free from mosquitoes.

OBSERVATIONS FOR PUPILS

1. Look on the tops of rain barrels and along the quiet margins of brooks for the soot-like egg-boats of mosquitoes. If found, bring them indoors and place them on water in tumblers or glass jars. Watch them hatch and note the size of the wrigglers when they first come from the eggs. Some of the mud and debris from the pool should be put into the tumbler because in this material the wrigglers will find bits of food.

2. If the eggs cannot be found, bring in some wrigglers from a rain barrel or a pool and watch them. They are very interesting in their movements and habits.

3. Note whether all the wrigglers are of the same shape and size. The slender ones are the larvæ and the ones with big heads are the pupæ. Study a larva first. What position does it take in the water? Note the tiny tube that is thrust up to the surface of the water. This is the

air-tube. What happens when the larvæ are disturbed? When they swim do they go head first or tail first? Do they go to the bottom of the jar when left alone? How do they return to the top? They find particles of food at the bottom. Note the brushes of hairs on the head. Do these brushes revolve? Why?

4. What is the main difference between the larva and the pupa? Where do the pupæ rest when not disturbed? Can they move? Note two little tubes on the "head," really the thorax, of the pupa. These are the air-tubes. How long does the pupal stage last? When the full-grown mosquito comes forth, how does it get out of the pupal skin? Why does oil on the surface of water kill the larvæ and the pupæ?

5. Find some full-grown mosquitoes and separate the males from the females. How many antennæ does the mosquito have? Are these hairy in the female? How are they in the male? On the head of the male are also two other long, hairy appendages, known as *palpi*.

6. Are the wings of the mosquito spotted or plain? If plain, it is probably a common *Culex*. How many wings has it? How does the *Culex* hold its body when it rests on the hand or the wall?

THE HOUSE-FLY*

Alex. D. MacGillivray

The house-fly, found in all the warmer parts of the world, is a nuisance and a pest wherever it occurs. It is one of the few species of insects that can be identified with certainty by those who have not studied insects carefully. There are many kinds of flies that closely resemble the house-fly in size and general appearance. Few of these frequent the house, however, and even then only a few individuals occur at one time. Over ninety-eight per cent of the flies found in dwellings are of one kind. There is only one species, and it is therefore worthy of the popular name of house-fly. Its habits deserve careful consideration.

The house-fly is black in color, with five parallel, more or less distinct, grayish bands on the back between the wings. There are two wings. The body and legs are covered with numerous short, stiff hairs, or bristles. New individuals are produced only during the summer season. They probably live for a few days to two or three weeks. On the approach of winter they become numbed with the cold and crawl into a crack or crevice or under rubbish, where they can find comparative warmth and protection. They lie dormant during the winter, scarcely moving until the first warm days of spring when they leave their winter home.

The first duty of the awakened hibernating female house-fly is to find a place in which to deposit her eggs. For this purpose she seeks a pile of

* The house-fly is a sucking insect.

horse manure, but if this is not available she will lay the eggs on almost any kind of manure. She usually places them in horse manure because it is the favorite food of the larva, the form of the insect that emerges from the egg. The eggs (Fig. 1, b) are minute, whitish objects, about one twentieth of an inch in length, shaped like a grain of wheat. Each female may lay four or five lots of eggs, each lot containing 100 to 150 eggs, or a total of 400 to 600 eggs. It requires eight to twenty-four hours, depending on the temperature, for the insect to complete its growth in the egg.

The small larva (Fig. 1, c) that issues from the egg through the broken eggshell is footless, is about as long as the egg, and is known as a maggot. It is during the larval period that the insect feeds and stores up fat to sustain it during its later life. At the end of a period of five to seven days the larva is fully grown and has molted its skin three times. The body is now about one third of an inch long, pointed at the head end and blunt at the other end.

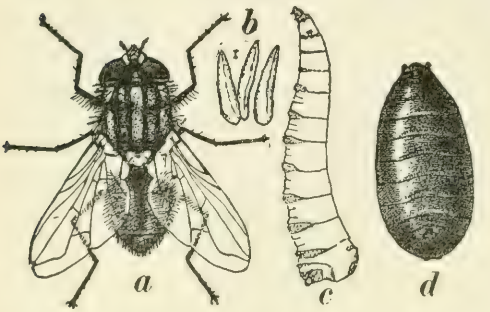


FIG. 1.— *House-fly: (a) adult; (b) eggs; (c) larva, or maggot; (d) puparium. All enlarged. (From Howard)*

When the larva is fully grown it stops feeding. The body becomes much contracted or shortened, and barrel-shaped. The outer larval skin is dried, wrinkled, hard, and brown in color. The insect shrinks away from this brown skin, becomes entirely free from it, and uses this skin merely as a shell to protect it during the striking changes that it must now undergo. The shell is the puparium (Fig. 1, d). The short-bodied insect enclosed in the puparium is the quiescent pupa. The pupa does not take any food. It is during this stage that the legs and the wings are formed. Five to seven days are required for the transformation of the pupa into a fully formed fly (Fig. 1, a). When this time is reached, the pupal skin is molted, freeing the fly, which breaks off the head end of the puparium, escapes from it and from the pile of manure, and begins its life as a winged insect.

If the time required for each of the life periods given above be added together, it will be found that ten to fifteen days are required for the complete development of a house-fly. This makes it possible for the production of six to eight generations of flies during the warm months from June to September. The mortality among insects is always high,

but if only twenty-five individuals from the 100 to 150 eggs laid should reach maturity in each generation, the descendants of each wintering female by the close of the sixth generation would be over one hundred thousand. This explains why house-flies may be so abundant during the months of August and September. That they usually are so abundant is due to the fact that no care whatsoever is taken to have all the piles of horse manure removed during the summer so that there will be no substance on which the female flies can lay their eggs.

The presence of flies in the home is a great nuisance, but this is the least important fact connected with them. The adult fly visits all sorts of filth, manure, slop-pails, pig-pens, and decaying animals and plants, among which it finds its food. Unless windows and doors are properly screened, flies are constantly passing from this filth to the kitchen and dining-room, walking over the food. In passing over the filth, thousands of bacteria cling to the hairs on their bodies and legs and to the pads on their toes. A part of these bacteria are left later on our food or washed off in the milk that we drink. If there should be among the bacteria those producing typhoid fever, tuberculosis, or any one of the numerous bacterial diseases to which man is subject, the possibility of his taking the disease would be very great. The house-fly is so important a factor in the carrying of typhoid fever that an eminent entomologist urges that in the future this insect should be known as the typhoid fly.

MAY BEETLES*

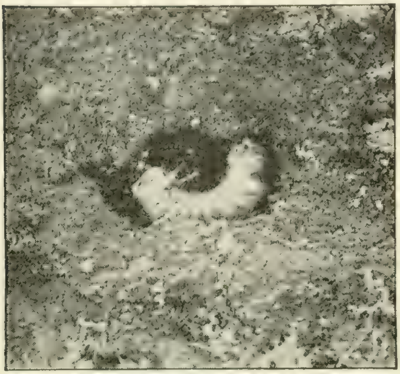
GLENN W. HERRICK

Most of us are familiar with the somewhat large brown beetles that come buzzing in through our open windows in May and June. They blunder against the wall, fall on the floor with a thud, and in a moment we hear their tiny claws scratching on the wall as they try to climb up the side of the room. These beetles are the parents of what are generally known as white-grubs. White-grubs live in the soil, preferably in grass fields such as old meadows and pastures. Here they live on the roots of grasses and sometimes cause severe injury, especially in meadows and lawns.

The beetles and their habits.— There are at least nine species of May beetles the larvæ of which, known as white-grubs, are injurious to certain farm crops. The beetles themselves are mahogany-brown in color and vary from one half inch to over an inch in length. A May beetle has a pair of hard, brown wing covers on the back, which meet in a straight line down the middle and partly cover the sides of the body Underneath the wing covers is a pair of thin, translucent wings

* May beetles are biting insects.

which are the real organs of flight. When a beetle is flying the wing covers are opened wide and held up out of the way of the true wings.



A white-grub, the larva of the May beetle, in cell in soil

The thin wings are larger than the wing covers and have to be folded in order to go under the wing covers when the beetle is at rest. Sometimes a beetle is careless and does not fold the wings neatly beneath the covers but leaves the ends sticking out. The legs of May beetles are long, rather slender, and covered with hairs and stiff spines. Each leg ends in two sharp, curved claws, each of which bears a sharp spur. Each beetle is provided with a pair of stout, black, biting jaws with which it can bite off bits of leaves.

Some species, at least, of May beetles have the very interesting habit in June of migrating about dusk from the fields to certain trees where they feed during the night. In the morning, just before daybreak, they all swarm back to the fields, where they remain during the day. The beetles feed on oaks, elms, willows, and poplars and sometimes injure the trees severely. Often there are so many of them among the trees that they sound like a swarm of bees.

Life history of a May beetle.— The eggs of May beetles are laid in balls of earth a few inches below the surface of the ground, and the grubs that hatch from them pass their entire life in the soil. It is therefore very hard to follow the life of a white-grub because it is hidden from sight all the time. So far as the author is aware, the life of but one individual May beetle of the commoner species has ever been followed from the egg to the adult.

The May beetle with wings spread

An egg of one species of May beetle, as recorded by Doctor Chittenden in Washington, was laid on June 8, 1893. In about eleven days a white-grub was hatched from it that lived in the soil until August 8, 1895, or a little over two years. On the 8th of August

this grub changed to a pupa and twenty-three days later, on August 31, it changed to a beetle. If it had been left alone the beetle would probably have remained in the ground until the next spring, in 1896, thus making nearly three years from the egg to the beetle. It is supposed, from this record and from many other observations made by different persons at different times, that most of the May beetles in our northern States take three years for their life history. It has only recently been shown by an investigator that one of the less common and less injurious species passes its life history in two years.

The grubs grow slowly while in the soil. During the first summer they are small and cause very little injury. In the second summer they are larger and destroy more, and in the third summer they have become nearly full-grown. Then they are ravenous and demand large quantities of food. It is during this last summer in the ground that they do the most injury.

Appearance and habits of white-grubs.— White-grubs vary in size from about one inch to over an inch and a quarter in length. They have a brownish head, with a pair of strong, black, horny jaws. Just back of the head are six strong legs, the end of each one of which is flattened somewhat like the foot of a mole. Probably the feet are used for digging burrows through the soil.

The body of a white-grub lies in a half-curled position; in fact, it is impossible to straighten the body and make it remain straight. The rear end of the body is blunt, rounded, and often darker in color than the rest of the abdomen.

White-grubs are sluggish creatures, and it is belived that they do not move far from the place in which they were hatched from the eggs. It is true that they move through the soil to some extent, for an infested place in a lawn or field will gradually enlarge in all directions. This shows that the grubs move slowly outward in all directions from the place at which they started, gradually devouring the roots of the plants as they go; but they are not known to migrate from field to field. During summer the grubs keep near the surface of the ground, but in the fall they go down out of the way of the sudden changes of thawing and freezing. In the spring, after the frost is out of the ground, they return near to the surface again.

The number of white-grubs sometimes present in a field is really amazing. Doctor Forbes and his assistants showed that in a badly infested ten-acre field of corn in Illinois there were, on the average, more than thirty-four grubs to each hill of corn, or about three hundred pounds of grubs to the acre. This is not an uncommon number to be found in the soil.

Crops destroyed.— We have already alluded to the preference of white-grubs for the roots of grasses. We once saw the roots of the grass of

a large and beautiful lawn entirely eaten off by these ravenous white-grubs. Where the grubs were in the soil the grass on the lawn could be rolled up like an immense fleece of wool. We had letters from correspondents during the summer of 1912 who said that their pastures and meadows had been injured in exactly the same way. The roots of the grass had been eaten off and the sod could be rolled up like a great rug or carpet.

Potatoes eaten by white-grubs

Corn is a favorite food crop of white-grubs. This is especially true in the great Corn States of the Mississippi Valley. In Illinois and Indiana often large fields of corn are practically destroyed by white-grubs. Potato crops are often badly injured by these insects. During the summer of 1912 we had many complaints of injuries to potatoes. We saw one small field of potatoes in which there was hardly one perfect tuber. The grubs gnaw into the sides of the tubers and eat out large cavities. In the illustration on this page are shown some of the potatoes taken from the field to which we refer. The ground in this field was practically full of grubs.

Strawberries seem to be greatly liked by white-grubs. The grubs eat off the roots of the plants, which wilt and break off at the crown. The insects seldom seem to be distributed evenly throughout the field, but appear to be present in certain spots in which all the plants may be killed.

Methods of control.— There is nothing that can be put on the fields to kill the white-grubs. In the case of a lawn or similar small area the soil may be soaked with a ten-per-cent solution of kerosene emulsion, which should then be washed in by soaking the ground with water.

Pigs are excellent agents for ridding infested soil of white-grubs. They root over the whole surface of a field and catch every grub within reach, even going to a depth of a foot or more in quest of the insects.

Corn, oats, and other grass-like plants and potatoes are liable to injury from white-grubs when sown or planted on newly turned sod, especially if the sod is more than two years old. There is always some risk from injury by these pests if sod land is planted to corn or potatoes. Probably the most effective way of preventing the ravages of white-grubs is to practice a three- or four-years rotation. Moreover, we believe this to be, in the majority of cases, good agricultural practice. By rotating crops the land need not remain in grass longer than two years at most, and the white-grubs will be prevented from gaining a foothold.

It is said that crows and blackbirds go to plowed fields and feed on white-grubs. If so, the crow is not so much of a pest as many think he is.

OBSERVATIONS FOR PUPILS

1. Catch some May beetles. How large are they? What color are they? Note the two hard wing covers on the back. How do these meet down the back? How many wings are under these? Describe these wings. Are they larger or smaller than the wing covers? How does the beetle get them out of sight under the wing covers? Determine, if possible, how a beetle carries the wing covers when it flies.

2. Find the two black jaws of the beetle. Examine a leg of the beetle and note the claws on the end of each leg. Note the spines on the legs.

3. Find a white-grub in the soil. In what position is it? What is the color of one of these grubs? How many legs has it? Notice the peculiar feet. Is the end of the body white? Does the grub have any jaws? Notice the row of dark round spots along each side of the body. How many of these spots are on each side? These are the openings through which air passes into the body; they are the breathing pores of the body and are called *spiracles*.

WASPS

ANNA BOTSFORD COMSTOCK

The wasps and the bees are near relatives and many unobserving persons do not know them apart. We had some polite neighbors once who came to us and told us apologetically that our bees had swarmed into their kitchen and were helping themselves to the preserves which were then being made. We hastened to the besieged kitchen and then we had to say apologetically to our nice neighbors that they certainly did not know bees from yellow-jackets, for there were only wasps taking toll of preserves in that kitchen; and yet the honeybees and the yellow-jackets are very unlike. The bee is fuzzy and broad-waisted, while the yellow-jacket is polished and narrow-waisted. However, the feature by which entomologists always distinguish bees from wasps is that the bee is provided with a pollen basket on each of her hind legs, which the wasps lack.

There are many kinds of wasps. In general they belong to two groups, the Solitary and the Social. The Solitary wasps are so called because each family lives by itself; that is, the mother wasp makes a nest for her young in the spring and only the members of one family grow up together. The mud daubers, the mason wasps, the carpenter wasps, and the digger wasps are all Solitary. Their wings when closed lie folded across the back.


The mud daubers, Solitary wasps

The mud dauber may be used to illustrate the habits of the Solitary wasps. She is a black, slender creature with blue-purple, iridescent wings, and is very common in New York State. She builds her nest of mud, which she finds in puddles and on muddy roadsides. She collects a pellet of mud in her jaws and by mixing it with saliva changes it to cement. She plasters these soft pellets under the roof-boards of some shed or garret. She has to make many trips in building a cell, which needs to be an inch long and perhaps a half inch in width. The walls are about one eighth of an inch thick; and, while the outside may be rough, the inside is very smooth. When one of these tubes is finished except for an opening left at one end, the mud dauber changes her labors and starts off spider-hunting. As soon as she sees a spider hanging snugly in its web she pounces down on it and stings it at just the right place in its nervous system to paralyze it but not to kill it. In her jaws she carries the helpless spider to her nest and packs it into the far end. Then she goes for more spiders until the nest is fairly full; and then she lays her egg in the cell and walls it up, spiders, egg, and all. From the egg hatches a white grub, for the young of all wasps are grub-like creatures. The little grub starts in at once to eat the helpless spiders and eats heartily, like most young


A mason wasp

creatures, until it has devoured all the spider meat so miraculously preserved for its use. It then changes to a pupa, and later changes to a wasp and gnaws its way out into the world.

The mason wasps build jug-shaped nests fastened to twigs, and provision them with caterpillars. The digger wasps make holes in the ground for their nests and provision them with caterpillars or grasshoppers. The carpenter wasps excavate tunnels in dead wood or in the pith of shrubs and use various insects for the food of their young. There are many Solitary wasps that use any cavity which they happen to find already made, but they all have this peculiar way of preserving the insect meat fresh for the food of their young. The sting of the Solitary wasps gives little pain to us and is very different from the sting of a yellow-jacket.

Yellow-jacket and nest

The Social wasps also are made up of many species and include those known as yellow-jackets and hornets—a large species being the white-faced black hornet, much feared even by brave boys. The Social wasps fold their wings peculiarly: each wing is folded lengthwise, like a fan, and extends down on each side of the body when at rest, instead of being closed above the back as is the case with the Solitary wasps and the bees.

The story of the yellow-jacket will illustrate the habits of all the Social wasps. The queen mother survives the winter in some protected place, and in the spring builds a little nest of paper. She bites off bits of wood and chews them into a pulp, and with this material she makes several cells and surrounds them with a protecting envelope. She lays an egg in each cell; these eggs hatch into little white grubs, which she feeds dutifully at first with partially digested food from her own stomach and then with any food that she happens to find which is acceptable to them. Thus they gain their growth and each spins a little veil over its cell, changes to a pupa, and later emerges as a full-grown worker ready for business. These workers at once assume all the duties of the queen except that of laying eggs. They enlarge the nest and feed the young and protect the nest from enemies.

Often one of these wasp nests will show several combs, one below the other. They differ from the combs in a beehive in the following respects: they are made of paper instead of wax; the cells open only on one side,

the lower side; they are not used for storing honey, but merely as cradles for the young wasps. It is interesting to see one of these combs with each cell filled to its utmost with a chubby little grub that has a head like a drop of amber honey — a head that is always protruding from the cell in order to attract the attention of the worker nurses when they bring in food. One might suppose that hanging head down these legless creatures would fall out of the nest; but nature has provided each with a sticky disk at the end of the body and this holds it fast in the cell.

Usually a yellow-jacket's nest is inhabited for one year only. All the inmates die off in the fall except a queen which was developed late in the fall. However, we have heard of one or two instances when a clever young queen took advantage of the old nest and used it for a second summer.

Although wasps are fond of sweets, their chief food consists of insects, and usually the insects that we can best spare, for they destroy many flies, mosquitoes, and injurious caterpillars.

THE IMPORTED CABBAGE BUTTERFLY*

GLENN W. HERRICK

The common green cabbage worm is one of the serious pests of cabbages in this country. It is the caterpillar of the white butterfly so often seen fluttering about in numbers over a field of these vegetables. This butterfly is an Old World insect and was probably imported among shipments of cabbages sent from Europe. It was first noticed in Canada in 1860 and by 1865 it had reached the State of Maine. From there it has spread over the whole United States and has become a much more serious pest than our own native cabbage butterfly.

The imported cabbage butterfly: male above, female below

This cabbage pest furnishes a good example of one way in which we are in constant danger of getting new insect enemies. Moreover, it shows how well a pest brought from another country may thrive under the new conditions found here.

Appearance of the insect.— The parent butterfly has two pairs of large, strong, white wings. Each of the front wings has a black patch in the outer corner; those of the mother butterfly bear two black

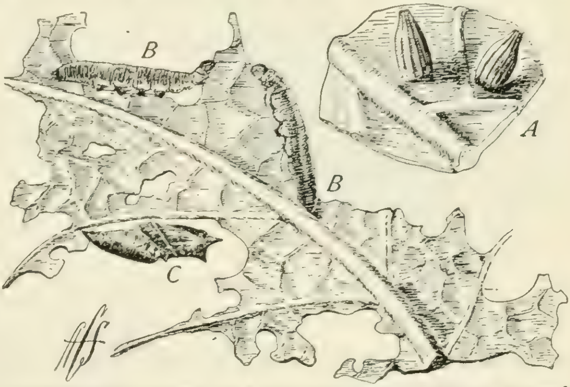
* The larva of the imported cabbage butterfly is a biting insect.

spots in addition, while those of the father insect bear but one black spot. The undersides of the wings are sulfur or straw color. The body of the butterfly is long and slender, and dark in color. Two long, slender feelers, or antennæ, project from the head. Each antenna ends in a swollen knob.

On the lower side of the head of the butterfly is a long, slender, thread-like projection coiled up like a tiny watch-spring. This is the sucking tube of the mouth. When uncoiled it is half an inch in length.

The caterpillar is velvety green in color and about one and one fourth inches in length when full grown. There is a faint yellow stripe down the middle of the back and a row of yellow spots along each side of the body. The caterpillar eats out holes in the leaves of the cabbages and, if abundant, practically devours the leaves.

Story of its life.— The butterflies appear early in the spring and the mother insect begins to fly about among the cabbages. She flits here and there, resting for a moment now and then on a cabbage leaf. If we examine the place carefully where she has rested, we shall find a small, pale yellow egg stuck to the leaf. In about one week the egg hatches and the tiny green "worm" appears. The caterpillars eat ravenously and grow very fast. They riddle the outer leaves of the plant and many of them crawl down among the tender leaves of the head itself. Here they feed and cause much injury by soiling the tender white leaves. In about two weeks they become full-grown and then change to pupæ. The pupa forms a chrysalis, which may vary in color depending somewhat on the color of the object to which it is attached. The chrysalis is attached by a small band of silk around the middle and by a small mass of silk at the pointed, or posterior, end. The chrysalides may be found attached to the undersides of cabbage leaves, boards or palings of a fence near by, or other convenient objects. During the summer the chrysalis stage lasts for one to two weeks. At the end of this time the chrysalis breaks open on the back near the larger end and the butterfly gradually works its way out. After the butterfly has drawn out all



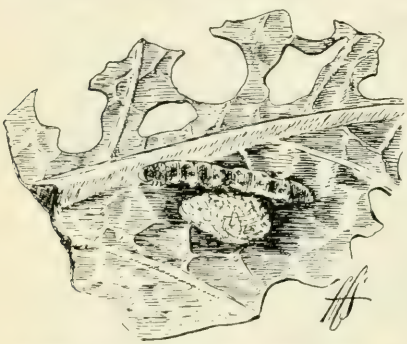
Parts of cabbage leaf, with eggs at A, caterpillars at B, and chrysalis at C

its legs and is entirely free from the shell of the chrysalis, it rests quietly while its wings gradually expand and dry and then it flies away.

The whole life cycle, from the laying of the egg to the appearance of the butterfly, is passed in twenty-two days to five weeks. In New York the cabbage butterfly finds time during the summer season for at least three broods. Farther south, where the summers are longer, there must be four or five generations each season.

The winter is passed in the chrysalis stage. The last chrysalides formed in the fall, instead of bursting open and giving forth a butterfly, remain unchanged until warm weather of the following spring.

Natural enemies.— The green caterpillars are subject to the attacks of certain tiny, wasp-like, parasitic insects that kill many of them and aid greatly in controlling this cabbage pest. Very often one of the dead green caterpillars is found attached to a cabbage leaf and partially covered by many small white objects, usually considered eggs by those who do not know. As a matter of fact, these are the cocoons of the tiny parasites that have lived within the body of the caterpillar and killed it. When the parasites are full-grown they leave the caterpillar and spin their small white cocoons on the outside, from which the small, dark-colored, wasp-like parasites emerge in a few days ready to parasitize other cabbage worms. Whenever a lot of these white cocoons are seen about a green caterpillar they should not be destroyed, but should be allowed to remain undisturbed so that the parasites may emerge to work on other "worms."



A dead cabbage worm, with a cluster of cocoons of the parasites that killed it

Methods of control.— This cabbage pest is best controlled by spraying the plants with one of the arsenicals, paris green or arsenate of lead. There is no danger in spraying cabbages with a poison up to the time they are half-grown, and even later. A cabbage is only a gigantic bud and grows from the inside outward as does any other bud. The outside leaves never fold up about the head, hence there is little danger of enclosing the poison within the cabbage.

If paris green is used it should be applied at the rate of 1 pound to 150 gallons of water, or sifted on dry, in the latter case being thoroughly mixed with flour at the rate of 1 pound to 25 pounds of flour. This should be applied in the morning while the dew is yet on the cabbage leaves.

Arsenate of lead may be applied at the rate of 2½ pounds to 50 gallons of water.

The first applications of poison should be made when the "worms" first appear, while the cabbages are young. Other applications should follow as needed.

OBSERVATIONS FOR PUPILS

Watch the butterflies in the garden and describe their manner of flying. Do they soar like a bird and do they fly long distances at a time? When one alights on a cabbage leaf see, if possible, what she does. See whether a tiny egg can be found sticking to the leaf.

Where on the cabbages are the green caterpillars found? How do they injure the leaves? What kind of mouth-parts do the caterpillars have? What color are they? Do the bodies have any colored lines or spots? How can the caterpillars be killed?

Find some of the chrysalides. How are they attached to the leaf or board? Describe their color and shape? Draw one of the chrysalides. Watch one and see how the butterfly gets out of the case.

How many wings has the butterfly? What is the ground color of the wings above and below, and what and where are the markings?

How many antennæ has the butterfly? What is the shape and length of each one? Draw one of the antennæ. Find the coiled sucking tube on the underside of the head. Uncoil it by passing a pin through the center of the coil and straighten it out. How long is it? This tube constitutes the mouth-parts of the butterfly. With it the butterfly can suck up nectar from flowers.

Note.— Moths and butterflies have great interest for little children. Many of these insects are large and handsome, and the children learn when very young the marvelous life history which is often demonstrated in a schoolroom. Teachers often make mistakes in statements connected with the metamorphosis of a moth or butterfly, speaking, for instance, of a butterfly as coming out of a cocoon, and the like. It will be well, therefore, if the teacher will learn carefully the following facts and try to fix the knowledge by personal observation:

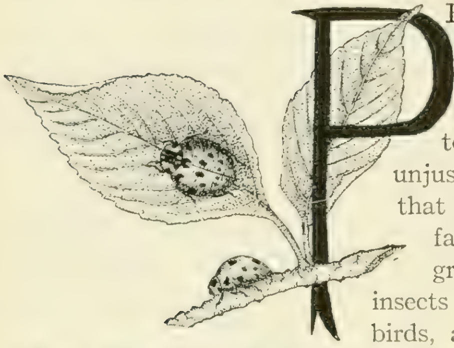
The most important thing to remember in the study of moths and butterflies is that they appear in four different forms during their lives. These forms are the egg, the larva, the pupa, and the adult.

Butterflies have uncovered pupæ. They fly by day. The wings are folded over the back when at rest. The antennæ, or feelers, have knobs on the ends. The body is slender.

Moths have pupæ either inside cocoons or protected by being underground or in some sheltered place. Many moths fly at night. The antennæ are never knobbed. Moths leave the wings spread when they are at rest. The body is stout.

LADY BEETLES

ANNA BOTSFORD COMSTOCK



PERSONS who do not know about the small brothers of the fields have an idea that all insects are injurious to our human interests. This, however, is a very unjust view; there are many insects that spend their whole lives doing us favors, even though we show no gratitude. Some of these beneficial insects belong to the family of ladybirds, as these small beetles are called. In fact, all except one or two members of this family are very friendly indeed to the gardener, the fruit-grower, and the farmer; for, instead of feeding on plants, they feed on the plant lice and the scale insects that infest plants.

The ladybirds, or ladybugs, are small beetles that look like pills of various sizes cut in half with legs attached to the flat side. Some species are brownish red with black spots; some are black with reddish or yellowish spots. Throughout the land, whenever a country child sees one of these ladybird beetles, he addresses it thus:

> " Ladybird, Ladybird, fly away home,
> Your house is on fire, your children will burn."

But ladybird is not at all frightened at this piece of news, because she does not know where her children are, and I am afraid she would not know one of them if she met it. She performed her last duty to her family when she laid a cluster of yellow eggs on the underside of a leaf of some plant infested with plant lice or scale insects; and from every one of these eggs hatched a little creature that is very different in appearance from its mother. It is a long, rather flat, velvety creature, covered with warts and short spines, and black or brownish black in color ornamented perhaps with some bright-colored spots. It moves around briskly on six stiff little legs, one pair to each of the three segments of the body next to the head. The first thing that this little creature does is to hunt for a stupid plant louse or scale insect and promptly seize it with strong jaws and chew it with great gusto, not leaving even a leg to tell the tale. A great many of these insects must share a like fate before the larva ladybird grows enough so that its skin is too tight for comfort. When this occurs the old skin is shed and a new skin takes its place, giving the greedy youngster plenty of room, so that it starts on a new crusade against the plant

lice and then repeats the process. At last, when it is perhaps half an inch long, some day it hangs itself up and sheds its old spiny skin and changes into a queer little spotted pupa. Here it hangs, still and helpless, for some days, and then the pupa skin bursts, and out comes a little hemispherical ladybird which may soon be ready to lay more eggs. Or, if too late in the season for this, she may seek a cozy nook in which to pass the winter. We often find her in the curtains about our windows and we should be very careful not to harm her; instead, we should cherish her and let her out when spring comes, so that she can go on helping us. The help that the ladybirds give us is all the more valuable because both plant lice and scale insects have mouth-parts in the form of a sucking tube, which is pushed down into the stem of the plant, thus reaching the sap and sucking it up, injuring the plant. Spraying the plants does not inconvenience these insects at all, because they never get a taste of the poison applied to the outside of the plant.

Larva, pupa, and adult of a species of ladybird

If we look at a ladybird carefully we can see that she has attached to her head a pair of short, club-like antennæ. Behind the head is the thorax covered with a shield, which is broader toward the rear and is ornamented in various patterns. The head and thorax together occupy scarcely a quarter of the length of the insect, the remainder consisting of the half-globular body encased in polished wing covers. Below these wing covers is a pair of long, dark wings, which are folded crosswise when at rest.

The ladybird is a good flyer as well as a rapid runner. One of the greatest achievements of economic entomologists was the introduction on the Pacific Coast of a ladybird from Australia, called the *Vedalia*, which preys on the cottony-cushion scale insect, a species of insect introduced from Australia also and very injurious to orange and lemon trees. Within a few years the introduced ladybirds had completely exterminated this pest.

LESSON FOR PUPILS

Method.— The ladybird beetles are very common in the autumn and may then be brought to the schoolroom and passed around in phials for the children to observe. As many species as possible should be collected. The ladybird larvæ may be found on almost any plant infested with plant lice. A plant with the insects on it may be brought into the schoolroom and studied.

Observations for pupils.— 1. How large is the ladybird? What is its shape?

2. Describe the colors of your ladybird. How many kinds have you seen?

3. Can you see the ladybird's head and antennæ? Can you see, back of the head, the thorax covered with a shield? How is this ornamented?

4. What are the colors of the wing covers? How many spots are there on them? Describe the position of the wing covers when the ladybird is flying. Where does the ladybird keep her true wings when at rest? Describe the wings.

5. Note the legs and feet and describe them. To what part of the body are the legs attached? Is the ladybird a good runner?

6. Describe how a ladybird plays possum when disturbed. Of what use is this to the insect?

7. Describe a young ladybird. Does it look like its mother? What is its shape? Is it polished like its mother, or is it warty and velvety?

8. How does it act when eating? Can you see how it uses its jaws when eating? Describe its legs. Is there a claw at the end of each foot?

9. Describe the action of the ladybird larvæ in attacking and eating plant lice or scale insects.

10. Describe how a ladybird larva grows by shedding its skin.

11. Feed the larva by placing it on fresh plants covered with plant lice, and note its growth. What happens when it changes into a pupa? How does it look when in the pupa state? What happens when the pupa skin bursts?

12. Where do the ladybirds spend the winter? Why should we take good care of them?

THE KINDS OF SPIDERS MOST COMMONLY SEEN

ANNA BOTSFORD COMSTOCK

The web weavers.— These spiders include the cobweb weavers, in the corners of ceilings or cellars; the funnel-web weavers, which spin their sheets of web on the grass; the curled-thread weavers, which spin irregular webs over weeds and flowers, especially goldenrod and wild plants; and the orb-web weavers.

The crab spiders.— These spin no webs, but lie in wait for their prey. They are crab-like in appearance and move backward as readily as forward. They live chiefly on fences and on plants; some of the species conceal themselves in flowers, where they lie in wait for visiting insects. These spiders are colored like the flower in which they hide; they are yellow when in the goldenrod, and white when in the white trillium.

The running spiders.— These are large, dark-colored, hairy spiders often found under stones and logs or boards. They run very swiftly

and thus overcome and capture their prey. They spin no webs, but the mother spider makes a very beautiful globular sac in which she places her eggs, and she often carries this egg sac with her, attaching it to herself by means of her spinnerets.

A crab spider

A jumping spider

The jumping spiders.— These spiders are of medium size. They make no webs, but spin nests in which they hide in the winter or when laying eggs. They have short, stout legs, and are often gray and black but sometimes have bright colors. They are remarkable for their powers of jumping. They move sidewise or backward with great ease and can jump a long distance. One of these jumping spiders, "dressed in a suit of pepper and salt," we often find on a windowpane, and if you put the point of a lead pencil within an inch of his face you are likely to see a remarkably high jump. He regards the moving pencil as a fly and it is his business on the windowpane to catch flies by jumping and seizing them, as a cat jumps after a mouse.

The garden spider; an orb weaver

Much has been said about the bloodthirstiness of the spider; but spiders, like the rest of us, are obliged to eat in order to live, and their ways of securing their prey are no crueler than our methods of procuring chicken or lamb for our tables. To one who has watched the spiders carefully it would seem that, after all, their chief characteristic is patience. They spin their webs and then sit and wait until some unwary insect is entangled, and whole days may elapse before a meal is thus obtained.

A running spider carrying her egg sac

"A noiseless, patient spider,
I mark'd where, on a little promontory it stood isolated;
Mark'd how, to explore the vacant, vast surrounding,
It launch'd forth filament, filament, filament out of itself
Ever unreeling them — tirelessly speeding them."

WALT WHITMAN

NOTES

The Editors

Among the insects given for recognition is the cankerworm. In localities in which this insect is found, nearly all the boys and girls are familiar with the larval form. In directing the observational work of the pupils, the following will be helpful:

1. The adult is a moth. The male has wings; the female is wingless.
2. The larva is one of the measuring worms. If the tree on which the larvæ are feeding is jarred, they will make silken threads by means of which they suspend themselves.
3. There are two species of cankerworms. In one the greater number of moths mature in the fall, and hence the name fall cankerworms; in the other the insects emerge as moths in the spring and are called spring cankerworms.
4. The pupal state of the cankerworm is passed under the surface of the ground.
5. The wingless female crawls up the trunks of trees in order to deposit her eggs in a suitable place. The eggs hatch into the "worms," that in many localities do much damage to orchards and to shade trees.
6. Since the female is wingless and therefore has to crawl up the tree in order to lay her eggs, sticky bands are placed about the tree trunk so as to prevent her from reaching the twigs; printer's ink is sometimes used on the bands.
7. The common birds feed on the cankerworms, the chickadee being foremost in active service. The birds eat many of the eggs also.

* * * * * * * *

Another insect to be recognized in this year's work is the horsefly. This is a well-known pest of stock and it is most abundant and annoying during the hot summer days. Some points of discussion that may be of interest in connection with the horsefly are as follows:

1. That it is common in woods as well as about stock.
2. That it has great rapidity of flight.
3. That it is the female which sucks the blood of animals. When she cannot obtain blood she takes the sweets of plants.
4. That the male feeds on the nectar of flowers and on sweet sap.
5. That the larvæ of the horsefly feed on small animal forms such as snails, the larvæ of insects, and the like. (See Manual for the Study of Insects, Comstock, page 453.)

PLANT STUDY

Editors' note.— The radish is given in the syllabus as the plant for special study this year, but the officers in charge of the work in the State Education Department have decided to substitute the study of oats. The radish is of comparatively little importance and nearly all boys and girls know what the plant is and how to grow it.

OATS

E. G. MONTGOMERY

PROBABLY all teachers of rural schools will be able to give a few lessons on oats during the year. Oats are the most extensively cultivated cereal in New York State. The value of the crop, as compared with other cereal crops, is shown by the following statistics for 1910:

Crops	Value
Oats	$19,000,000
Corn	16,000,000
Wheat	10,000,000
Barley	1,500,000

There are only four States with an oat crop more valuable than that of New York, namely, Illinois, Iowa, Minnesota, and Wisconsin.

About four and three tenths acres out of every one hundred are devoted to oats in New York. The average yield is thirty-one and three tenths bushels and the average value is $13.44 per acre. The part of the State showing the highest production of oats is comprised in the counties bordering on the south shore of Lake Ontario, while the eastern half of the State produces oats to only a small extent.

It would be interesting to find how your own neighborhood compares with other parts of the State in oat production. Find by inquiry what percentage of the land in your district is devoted to the culture of oats, and its average yield and value.

Kinds of oats.— When the shape of head (or panicle) is considered there are two kinds of oats, known as the *true panicle* (Fig. 2) and the *side panicle* (Fig. 1). The oat grain is also of several colors, as white oats, black oats, red oats, yellow oats, and gray oats.

There are several kinds of oat *spikelets*, as shown in Fig. 3. Some have only one grain and others have three. In some varieties a long *awn* is borne on each grain. How many kinds of oat spikelets can you find?

Oat grains vary also in shape, certain varieties having long, slender grains while in other varieties the grains are short and plump. There are four hundred kinds of oats. How many kinds can you find growing in your neighborhood?

FIG. 1.— *Side panicle*

Parts of grain.— The oat grain can be separated into two parts, known as the *hull* and the *kernel.* The whole is called a *grain.* The hull has no food value, but the kernel is very nutritious. In making oatmeal the hull is first removed and only the kernel is milled. Oats constitute a valuable food for young growing animals or for horses at hard labor, but they are not used in fattening stock.

Food value.— The food value of the oat grain depends on the percentage of hull to kernel. About twenty-five per cent of a good oat is hull, but a poor oat grown in a bad season or on poor soil may have as high as forty per cent hull. (Determine the percentage of hull in a sample of oats by first weighing a small sample and then removing the hull and weighing again.)

Manner of growth.— Oats usually produce more than one head from a single seed. As the farmers say, the oats "stool," that is, branch at the ground and send up several stems from each seed. When sown thickly, not more than two heads are produced from a seed; but if the seeding is thin and the soil rich, as many as five heads may be produced from a single seed.

FIG. 2.— *True panicle*

Examine oat plants on various kinds of soil and see how many heads are produced to each seed.

The oat crop in New York State is so important that the teacher should take opportunity to discuss it whenever interest is shown. A few test questions that can be answered from the foregoing text will probably lead the girls and boys to think about the subject. Place the questions on the blackboard and have the older pupils consult reference books and make inquiries of farmers in the neighborhood before answering the questions.

Let one of the pupils place on the blackboard drawings from the illustrations on this page and then find out how many in the class have

ever noticed that some oats have true-panicled heads and some side-panicled heads. Appoint a committee of older boys to gather material for the study of oats next year. This will lead to observational work.

FIG. 3.— *Spikelets*

Questions.— In which States do we find oats most extensively grown? How does New York stand in the production of oats? What is the value in dollars of the oat crop of New York State? In what parts of the State do we find the most extensive oat fields? What percentage of the land in your district is devoted to oat culture? How many kinds of oats are there? How many kinds can you find in your neighborhood next summer?

Who grows oats most extensively in your district? Is the crop sold or used at home? If oats are not grown on some of the farms in your neighborhood, can you find out why? What effect has the kind of soil on the growing of oats? Do oats require a large or a small amount of moisture?

GROWING OATS

E. R. MINNS

Choosing the soil.— Oats will ordinarily make the best yield on a moist, fairly fertile soil. This crop requires a larger amount of water to bring it to maturity than do many other farm crops. If the soil is too rich in nitrogen, oats tend to lodge and that reduces the yield. A clay or clay-loam soil is most likely to contain the necessary moisture during midsummer, and a region that is naturally cool during most of the growing season is better adapted to oat-raising than is a warm region. The soil chosen should be well drained, in order that planting may be done early. Late-sown oats may fail to yield well if the summer turns warm and dry when the oats are making their most rapid growth.

Preparation.— In general practice, oats follow some intertilled crop such as corn or potatoes. They may be sown on either stubble or sod land, provided plowing is done the previous autumn and care is used in making a good seed bed. The ideal preparation is corn stubble that has been heavily manured the year before. Fall plowing on the type of soil best adapted to oats has the advantage of exposing the furrows to the crumbling action of frosts, giving the winter rains or snows a chance

to soak into the ground and making it possible to stir the ground and sow the oats at an earlier date in the spring than if the plowing is deferred until the opening of spring. However, good crops of oats can be raised on spring-plowed land if enough care is used in fitting the seed bed. The seed bed for oats should be fairly compact, level, and fine to a depth of two inches.

Fertilizers.— On land that normally causes oats to lodge, no nitrogen should be added in the way of fertilizers. Potash and phosphoric acid in moderate quantities may prove beneficial. The use of lime is claimed to be beneficial to the oat crop, and it is needed on many soils in order to insure a good crop of clover following the oats. A moderate application of one thousand pounds per acre of any good agricultural lime may be used if the soil is not well stocked with lime.

Seed.— Because oats are naturally adapted to a cool climate, it is often advantageous to use seed from a region farther north, or at least from a region that produces large yields of oats. If good seed can be obtained near by from varieties that have proved their worth as yielders such varieties can be used. Some varieties of oats tend to decrease in yield the longer they are grown in a locality. The introduction of new varieties from better oat-growing regions is sound policy. Some kinds of oats are very susceptible to the attacks of loose oat smut. If the seed used has had any of this disease present in the past, it should be treated with a solution of formalin and water in order to kill the smut spores before sowing the seed.

Harvesting.— If a good stand of oats is obtained and weeds and grass are not abundant, the crop is best harvested with a twine binder. Oat sheaves are more difficult to cure than are wheat sheaves. They may be set up in longer shocks, two sheaves wide without any caps, if the weather is fine. If rain threatens, cap-sheaves may be added if the oats are not yet cured. If weeds are numerous enough in the oat field to make curing difficult, it will be better to cut the crop with a side-delivery reaper, and turn the gavels of oats with a fork as they lie unbound on the ground so as to facilitate curing. If wet through by rain they can be dried out in a few days. In order to insure saving the grain it is best to cut the crop before all the stalks are ripe or while some are yet greenish in appearance. Cutting when too green will make a lighter yield of grain.

"*Near at hand,*
From under the sheltering trees,
The farmer sees
His pastures and his fields of grain
As they bend their tops
To the numberless beating drops
Of the incessant rain."

HENRY WADSWORTH LONGFELLOW.

SUGGESTIONS FOR THE STUDY OF A FEW ECONOMIC PLANTS TO BE RECOGNIZED IN 1913–1914

ALICE G. McCLOSKEY

Pumpkin. — There are many interesting observations of pumpkins, which may be encouraged during the autumn. The pumpkin vine, blossom, and fruit make good subjects for lessons in drawing and in color. A visit to a cornfield in which pumpkins grow should result in many lines of out-of-door observations. A few suggestions and questions that may be useful in the classroom are as follows:

Flower and fruit of pumpkin

1. Read to the class the following quotation from an article written by Dean Bailey for boys and girls:

"*In October the cornfields were golden with pumpkins. The corn was in shocks. The tassels were ripe and dry, and hung downward as if in mourning for the dying year. The maple leaves, yellow and red, were falling to the ground like flocks of brilliant birds. Lonely hickory trees held onto their dun-yellow leaves as if loth to let them go. But the pumpkins seemed to be in their prime. Fat and sleek they lay between the corn shocks, and shone out among the drying weeds. We did not remember to have seen them before.*

"*It is now November. Heavy frosts have come. One night the brook was frozen nearly to its middle. Much of the corn is still in the shock, but the pumpkins have been taken under cover. They lie in heaps on the barn floor. The hay and straw falls over them. Still the old cow can smell them. I like to sit on them and run my fingers down their smooth, broad grooves.*

"*In some parts of the State I miss the pumpkins in the cornfields. These are the regions in which there are many silos; corn is grown in large fields; corn harvesters are used; the absence of the pumpkin tells me of a change in the kind of farming since I was a child.*"

2. Have the children learn the following stanza from "The Pumpkin," by John Greenleaf Whittier:

> "*O,— fruit loved of boyhood! The old days recalling*
> *When wood grapes were purpling and brown nuts were falling!*
> *When wild, ugly faces were carved in its skin*
> *Glaring out through the dark with a candle within!*
> *When we laughed round the corn-heap with hearts all in tune,*
> *Our chair a broad pumpkin,— our lantern the moon,*
> *Telling tales of the fairy who travelled like steam*
> *In a pumpkin-shell coach with two rats for her team.*"

3. Send the children on a quest to find out how long pumpkins and squashes have been cultivated in this country.

4. Have brought to school as many kinds or shapes of pumpkins and squashes as can be found in the neighborhood. This will make a simple exhibit and give material for many lines of school work.

5. What kind of stem does the pumpkin have? How does the stem differ from that of the Hubbard squash?

6. Look at the blossom end of the pumpkin and at that of the Hubbard squash. How do they differ?

7. How do the pumpkin and the Hubbard squash differ in shape?

8. Can you see any difference in the seeds of the pumpkin and the Hubbard squash?

Observations of the pumpkin as to veining, color, and the like, should be encouraged. Have the boys and girls try to find out when the pumpkin flower closes. Have them locate the seeds in a young pumpkin. Discuss the pumpkin and Thanksgiving Day; the pumpkin and Hallowe'en.

Vetch.— The vetch belongs to the same family as do the clovers, beans, peas, and certain other plants. The plants are mostly climbing, have pinnate leaves, and bear their seeds in pods. The flowers are blue, violet, or sometimes yellowish white.

In this country the vetches are important as cover-crops for orchards and as forage crops. There are two varieties with which boys and girls may be familiar, the *spring vetch* and the *hairy vetch*. Whenever possible observations should be made on the climbing habit of these plants; the pinnate leaves; the pods; the purplish flowers of the *spring vetch*, borne two in each axil; the violet-blue flowers of the *hairy vetch*, borne in long, one-sided axillary racemes; the hairy-covered pods of the hairy vetch and the smooth pods of the spring vetch; the difference in the length and shape of pods of the two varieties.

Celery.— If celery is grown in the neighborhood it may be used for an interesting lesson that will lead to observations on cultural methods, quality, and the like.

Celery belongs to the same family as do wild carrot, poison hemlock, carrot, and parsley.

How many boys and girls know the average length of celery stalks, the number of leaflets there are on each leaf, what kind of flowers the plant bears, the number and size of the seeds, and in what manner the stalks are blanched?

*Barley.**— This grain offers material for interesting lessons. From time to time have the pupils collect in the neighborhood, for comparison, a few specimens of barley and some heads of wheat, oats, and rye. The following suggestions and questions may be helpful in conducting the lessons:

1. Which of the other grains does barley most nearly resemble? What cultural methods in growing barley are used in the neighborhood? What soil is best adapted to growing barley? Where is the seed obtained? How much is sown per acre? What is the average yield per acre in the neighborhood?

2. Note the sharp, rasp-like beards of the barley. Is there a difference in the beards when green and when ripe? In which condition is barley more safe as food for cattle? In what form is barley fed mostly to stock? Compare the length of the beards with the length of the grain-bearing part.

3. It will interest boys and girls to dissect a head of barley. In Fig. 1 can be seen one of the many spikelets that make up the head, dissected into its flower parts. With the older and more common types of barley the flowering glume is adherent to the kernel and can be removed only with difficulty. Still another type of barley has a flowering glume which is free. Barley types are ordinarily grouped, according to the number of rows of spikelets arranged on the sides of the main stem, into the *two-rowed* and *six-rowed* types. Sometimes, however, in the case of the six-rowed type the two rows on each of the two opposite sides overlap at the bases of their spikelets, giving the head of grain the appearance of being four-sided, or, as we say, four-rowed. The heads of the two-rowed type are usually longer and the grain is somewhat larger than those of the six-rowed type. The six-rowed type gives slightly greater yields of grain, however, due to the greater number of grains produced, and is therefore more extensively grown in this country. In the illustration the main types are shown.

FIG. 1. — *a, Entire spikelet; b, two outer empty glumes; c, flowering glume, bearing beard; d, kernel separated from flowering glume; e, palea, which holds kernel within flowering glume*

* Important facts included in the lessons on barley, redtop, and white clover were furnished by E. V Hardenburg.

4. The pupils should know that barley is not extensively grown in New York State because some of the more useful cereals, such as wheat, corn, and oats, produce good crops. Owing to its shallow root system barley can be grown where there is but little soil moisture. The great bulk of the barley crop of the United States is grown in those western States where the soil and climate are too dry for the production of other grains.

5. If there are reference books available, have the boys and girls find out how long barley has been cultivated and for what purposes. They should know that barley takes about the same place in European agriculture that corn takes in the United States. It is very frequently mentioned in English literature. One of the finest pastoral references in Tennyson's poems is the following from "The Lady of Shalott":

" Only reapers reaping early
In among the bearded barley,
Hear a song that echoes cheerly
From the river winding clearly,
Down to towered Camelot;
And by the moon the reaper weary,
Piling sheaves in uplands airy,
Listening whispers ''Tis the Fairy
Lady of Shalott.' "

FIG. 2.— *Types of barley: a, two-rowed, bearded, hulled; b, six-rowed, bearded, hulled; c, four-rowed, bearded, hulled; d, six-rowed, beardless, hull-less*

Redtop.— The study of grasses will be valuable for summer work. The difference in the size and shape of the heads of the grasses should be observed, also the difference in the seeds. The pupils may be interested to enter a competition that has for its object the best collection of grasses mounted and named.

Redtop is third in importance among our cultivated forage grasses. Timothy ranks first and Kentucky blue-grass second. Have the pupils find out how much redtop is grown in the neighborhood. If it is used instead of timothy, find out why.

A few facts that the teacher may find useful in the study of redtop are as follows:

1. Redtop is of value in many hay-producing regions in which conditions of soil and climate are unfavorable to the growth of other and more valuable grasses. Redtop will grow on low, wet farmlands that have never been drained, and on acid soils.

2. If Kentucky blue-grass and timothy can be grown, redtop is not desirable. The reasons for this are: (1) it deteriorates rapidly after reaching maturity; (2) its yield of forage is not so high as that of timothy, the yield when sown alone seldom exceeding a ton and a half per acre; (3) it is not nearly so palatable as most of the other cultivated grasses; (4) there is little market demand for it, the price obtained for baled hay being considerably less when redtop is seen mixed with the timothy.

Redtop

White clover.— The clovers have both economic and æsthetic value for nature lessons. In preparation for the study of white clover the pupils should be asked to bring to the school specimens of as many kinds of clover as they can find. The quest may result in the following: red, white, alsike, and perhaps one or two of the sweet clovers, which belong to a different genus of the family. The likenesses and differences of the plants will be of interest.

In the study of white clover the following may be considered:

1. The creeping stem.

2. The way in which the leaves reach up to the light. The pale, angular spot on each leaflet. The way in which the leaves close at night.

3. The many small flowers that make up the clover head; it is most interesting to look at them through a lens. Note the resemblance of the flowers to sweet peas.

4. The withering of the blossoms after they have been pollinated by bees.

5. The superiority of clover honey.

The boys and girls should be taught a few of the reasons why white clover is of economic importance. Among them are:

1. It is of value for the seeding of pastures and lawns, because, owing to its habit of lying flat on the ground and sending its roots downward from the many joints, or nodes, and its leaves and blossoms upward, a dense sod is formed. (See illustration, page 1206.)

2. It readily renews its growth after having been closely grazed.
3. It withstands tramping by animals in the pasture.
4. It is perennial in its habit of growth.
5. It has the habit of self-seeding.
6. It is able to endure drought.


White clover

White clover seed is considered expensive, often costing $18 to $30 per bushel of sixty pounds; but because of the perennial habit of the plant the expense of seeding need not be incurred often. A usual and wise practice is to add a little seed each year to the run-out places. White clover is rarely sown alone, partly because of the expense of the seed and partly because of its habit of making an uneven stand; it is sown in combination with Kentucky bluegrass or other pasture grasses, at the rate of four to six pounds per acre.

QUOTATIONS

"A sense of pureness in the air,
Of wholesome life in growing things;
Waving of blossom, blade, and wings;
Perfume and beauty everywhere;
Sky, trees, the grass, the very loam —
I love them all; this is our home."

RICHARD WATSON GILDER

"*Hush, ah hush*, the scythes are saying
Hush and heed not and fall asleep;
Hush they say to the grasses swaying
Hush they sing to the clover deep!
Hush — 'tis the lullaby time is singing —
Hush and heed not for all things pass,
Hush, ah hush! and the scythes are swinging
Over the clover and over the grass!"

ANDREW LANG

FIVE COMMON WEEDS

PAUL J. WHITE

Sour dock.— This unsightly weed is common by the roadside and about farm buildings. It is found also in old meadows that have not been plowed for several years. It grows two to three feet tall. Its most distinguishing character is the leaf, which is crinkly at the margins; hence the name "curled dock." The sour leaves are often used as greens. The blossoms are greenish, with no brightly colored parts. The small, dark brown, shining seeds are common in clover and grass seeds.

Beggar-ticks. The teeth on the prongs of the seed point toward the base of the seed

Sour dock is a long-lived plant, but it can be easily killed by plowing the land. It has a deep, straight root. If found growing in the yard it should be pulled or grubbed before the seeds are formed.

Ragweed.— This common weed, familiar to every farmer, is a pest in newly seeded meadows. It grows in cultivated fields and may often be seen along the roadside. The seeds are plentiful in clover seed and in small grains.

Ragweed lives but one year, yet it is one of the hardest weeds to control. The seeds will lie in the ground several years without growing, and when the field is again plowed they will spring up. The plants develop late in the season and mature in grainfields after harvest; therefore, when these weeds are numerous the stubble of grain should be mowed before the seeds are ripened. In cultivated fields none of the ragweed plants should be allowed to produce seeds.

Beggar-ticks.— This is not a common weed, yet it is one which we shall remember from the first introduction. It is a tall, smooth weed, found most frequently in moist, rich lands, and it lives but one year. The seeds are brown, thin, and flat, about one third inch long, and they have two, or sometimes three, forks at the top. These are barbed, the projections pointing backward. When the seeds become fastened to clothing they are removed with great difficulty. They also cause trouble in the wool of sheep.

These weeds are easily controlled by mowing with the scythe. They should be cut in summer before seeds are ripened.

Canada thistle

Canada thistle.— This weed is very common, especially in pastures. It occurs also in plowed land. It may be distinguished from other thistles by the root. If a plant is dug up it will be found to have heavy roots, called rootstocks, which extend some distance from the plant, parallel with the surface of the ground. These may be six to ten inches below the surface. Every three or four inches new plants grow up from these. One seed may in time produce a large patch of these weeds from the roots alone.

The Canada thistle spreads into new fields by means of seeds. These seeds may be sown with clovers, grasses, or even oats. Moreover, the seed has at the top a feathery attachment which permits the seed to sail away in the wind like a balloon to a new home where it will not be crowded by other seeds.

This weed lives many years and spreads every year unless destroyed. Merely plowing the land once will not kill it. That is the reason why it is so common in oat fields. A cultivated crop that is carefully tilled helps to destroy it. It can be destroyed in pastures by mowing twice a year, in June and August. It should not be allowed to blossom. If the plants are not too numerous they may be cut off below the surface of the ground and

a spoonful of salt put on the fresh cut. If persisted in as often as they appear, this method is usually effective.

*Burdock, or clotbur.**— This is a familiar enemy to most New York farmers. It is never found in cultivated land, but it may be seen frequently around deserted buildings and sometimes in fields or orchards in sod. The burs are one half to three quarters of an inch across and are covered with projections that end in hooks. They become attached to the clothing of persons and to the hair or wool of animals. This is nature's provision for scattering the seeds so that there will be no crowding when they are ready to grow.

Burdock

When the life history of this plant is understood it becomes a very simple matter to destroy the weed. The plant lives but two years and no seeds are produced until the second year. It grows close to the ground during the first season, but sends up stalks in the second year. If cut off below ground the first year or before going to seed the next year its life will be ended.

"'Good for nothing,' the farmer said,
As he made a sweep at the burdock's head,
But then he thought it was best, no doubt,
To come down some day and root it out.
So he lowered his scythe and went his way
To hoe his corn, to gather his hay;
And the weed grew safe and strong and tall
Close by the side of the garden wall."

"I will go root away
The noisome weeds, that without profit suck
The soil's fertility from wholesome flowers."

SHAKESPEARE, Richard II, Act III, Scene IV.

* The term clotbur is also applied to the cocklebur (Xanthium).

PLANTS TO BE RECOGNIZED IN 1913-1914

I. T. FRANCIS

Laurel.— An erect shrub with entire, evergreen, leathery leaves. The showy flowers are usually borne in clusters. The calyx is five-parted,

Laurel

or five-lobed. The corolla is saucer-shaped and five-lobed. There are ten stamens, which are shorter than the corolla.

The laurel is a member of the heath family, in which are found wintergreen, Indian pipe, Labrador tea, leatherleaf (or cassandra), trailing arbutus, huckleberry, blueberry, and cranberry.

Jack-in-the-pulpit.— This plant is sometimes called Indian turnip. It is found in rich woods. The leaves are usually two, each being divided into three oblong-elliptical, pointed leaflets. In the Jack-in-the-pulpit the very simple, naked flowers are borne in dense, more or less fleshy spikes, and the spike is enclosed in a large, corolla-like leaf, known as a *spathe*. The spathe is smooth or corrugated in its tubular part and its incurved hood. It is pale green, dark purple, or variegated, with dark purple or whitish stripes or spots.

This plant is a member of the arum family, to which belong the arrow arum, water arum, skunk cabbage, and sweet flag (or calamus).

Solomon's seal.— The Solomon's seal is a perennial herb, with simple stem from creeping, knotted rootstocks, naked below, bearing above nearly sessile or half-clasping, nerved leaves and axillary, nodding, greenish flowers. The perianth is cylindrical and six-lobed at the summit. There are six stamens.

The Solomon's seal takes its name from the scars of preceding stalks on the long, running rootstock. It belongs to the lily family and has for its near kin the lily, wake-robin, lily of the valley, asparagus, dog's-tooth violet, onion, and garlic. In the false Solomon's seal the blossoms are borne at the end of the stalk instead of in the axils of the leaves.

Honeysuckle.— The honeysuckle is an erect or climbing shrub, with entire leaves, calyx teeth very short, and corolla tubular, funnel-form, more or less irregular, and often swollen on one side. The corolla is five-lobed, with five stamens inserted on the tube. The flowers are often showy and fragrant. The fruit, a one- to several-seeded berry, is often formed by the ovaries of two adjacent flowers.

There are about one hundred species of honeysuckle in the North Temperate Zone, and a few species in tropical regions. The purple or pink azalea is sometimes called the wild honeysuckle, but this belongs to the heath family.

In the honeysuckle family we find the American and red-berried elder, hobble-bush, cranberry tree, maple-leaved arrow-wood, nannyberry, black haw, horse gentian, American twin-flower, and snowberry.

Honeysuckle

Dog's-tooth violet.— This plant is an almost stemless herb, which has smooth and shining flat leaves the petioles of which sheathe the base of the commonly one-flowered stalk. The flowers are nodding, the six divisions wide-spreading or recurved. The style is long and club-shaped. There are six stamens.

The name adder's-tongue is often used for these plants, although there is another plant family called the adder's-tongue family. We have the *yellow adder's-tongue*, with its leaves mottled with purple and its light

Dog's-tooth violet

yellow flowers; the white dog's-tooth violet, sometimes called the white adder's-tongue, with its leaves scarcely mottled; and other species.

The dog's-tooth violet belongs to the lily family, as do the onion, garlic, lily, asparagus, false Solomon's seal, Solomon's seal, lily of the valley, wake-robin, and others.

Crocus.— The common crocus is a small and stemless plant, with long-tubed flowers and grass-like leaves. It has two to four leaves to each flower. The leaves are covered with a whitish bloom on the underside. The flowers are lilac, variously striped, or sometimes white.

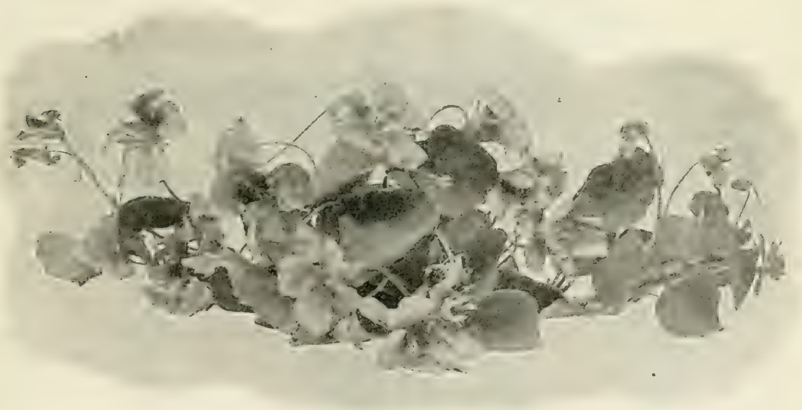
These plants belong to the iris family. In this family are also found the blue flag, blue-eyed grass, and gladiolus.

Iris.— The iris, or blue flag, belongs to the iris family. It is nearly always a strong plant, with rhizomes or tubers. The flowers are for the most part large and showy. The three outer segments are recurved, and the three inner ones, usually smaller, are more nearly erect and sometimes incurving. The leaves are long and sword-shaped.

In the iris family belong the crocus, blue-eyed grass, and gladiolus.

Nasturtium.— The nasturtium of the garden is well known. There are two kinds, the climbing and the dwarf. The plant is a tender herb, which, when climbing, does so by means of leaf stalks. The leaves are shield-shaped and about six-angled. One of the five sepals is extended into a long, nectar-bearing spur. The petals are usually five, with narrow claws, often bearded. There are eight stamens. The petals are much longer than the calyx and have many tints and shades of yellow and red, from cream color to almost black.

The nasturtium belongs to the geranium family, as do the common wild cranesbill, herb robert, and garden geranium.



Nasturtium

" O urging impulse, born of spring,
That makes glad April of my soul
No bird however wild of wing
Is more impatient of control.

* * * * * * *

" It tells me all that I would know
Of birds and buds, of blooms and bees;
I seem to hear the blossoms blow
And leaves unfolding on the trees."

MADISON CAWEIN

TREE STUDY

"*Peace of the forest, rich, profound,*
Gather me closely, fold me round;
Grant that the trivial care and strife,
The petty motive, the jarring sound,
Melt and merge in your lovelier life.
The myriad whispers of grass and pine,
The stir of wings in the quest divine,
I claim their music and make it mine."

ELIZABETH R. MACDONALD

THE ELM

John Bentley, Jr.

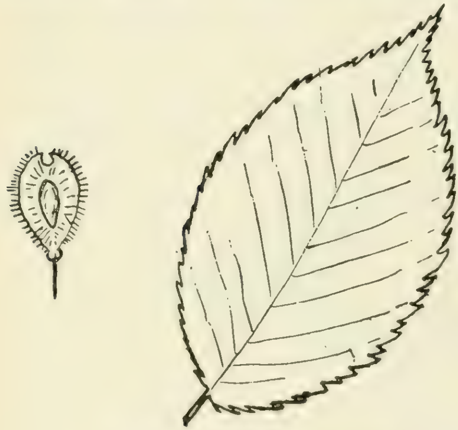
Of the many trees that are common in New York State, the elm is doubtless the most familiar to boys and girls. The reason for this is plain, when we consider that the elm is a tree of the farms, the home lawns, and the streets of the towns, rather than a tree of the deep woods. While it is found occasionally in the forest, it is almost always scattered among other trees and never forms a large proportion of the forest, as do maples, birches, pines, or oaks. Throughout the New England States, New York, and Pennsylvania, the elm is one of the commonest shade trees, not only for the streets of the towns and villages but also for the grounds about the home. The tree is so graceful and beautiful, and, when old, so stately and dignified, that it well deserves the place which it holds in the estimation of the people.

The elm has a very distinctive form and habit of growth. Other trees seen from a distance are not always easy to recognize: the maple and the beech look somewhat alike, especially when young; the oak and the chestnut, the ash and the hickory, resemble one another slightly. But the elm, with its massive trunk — which quickly breaks up into several large branches, giving the tree an urn-shaped appearance — and the delicacy of the twigs and branchlets, forming a crown with a fringe-like margin, is easy to recognize even at some little distance. To a remarkable degree it combines strength with grace and beauty.

The elm is a widely distributed tree. It is found in southern Newfoundland and through the southern part of Canada as far west as the northern shore of Lake Superior. It grows along the Atlantic coast as far south as Florida, although it never reaches very large size in the southern part of its range. Westward it is found from South Dakota to Texas, although not in such large numbers as in the East. Everywhere it shows a preference for the low, rich lands that border rivers and streams, and it grows to its largest size where the soil is rich, fertile, deep, and moist. Under favorable conditions it will grow to a height of one hundred and twenty feet and a diameter of eleven feet. Many very large trees have become famous, as the large elm at Lancaster, Massachusetts, and the two elms on the river bank at Wilkes-Barre, Pennsylvania. It is the wide spread of the branches, as well as the massive size of the trunk, which makes the elm impressive; sometimes the crown of a tree measures one hundred and twenty feet across.

The elm tree, large as it is, springs from a very small seed. The flowers, which are inconspicuous, blossom early, before the leaves are fully grown, fade soon after, and are as quickly followed by the ripening seeds. These small seeds have wings on the margins, with sharp points, and are very

short-lived. Unless they fall on soil that makes a good seed bed and germinate immediately, they will die. They cannot wait, as do the seeds of the hickory, pine, and many other familiar trees. (Can you think of another familiar tree that ripens its seeds in early summer? See the Rural School Leaflet for September, 1912, page 163.) Besides plenty of moisture, which is one thing that the little elm seedling must have at the start, the quality of the soil and the amount of light that comes to the seedling have great influence on its growth. The soil must be rich and mellow, so that the rootlets can penetrate easily and find plenty of food material, and there must be plenty of light, so that the seedling can grow rapidly and become able to take care of itself before the autumn frosts arrive. This demand for light is one reason why we do not find elm trees in the deep, dark woods. When we do find an elm in the forest, it is because there was an opening in which the little seedling could get a start. Elms will not do well when they are overtopped by their neighbors.



Leaf and fruit of American elm

When standing where there is plenty of room and light, the elm tree grows rather rapidly. Many men who do not consider themselves old can remember the time when, as boys, they watched their fathers set out elm trees along the roads or on the lawn, and those trees have now grown to be of large size. But the largest elms — those that are one hundred feet high and six to ten feet in diameter, with the large, spreading crowns — are probably two hundred years old or even older.

Whether the elm is more beautiful in summer or in winter it is difficult to say. In summer its dense foliage hangs in graceful sprays from the drooping branchlets at the ends of the long limbs, swaying in the breeze and making a delightful shade. The upper side of the leaf is dark green; the under side is grayish green, reflecting a soft light which is very pleasant. Stripped of its foliage the elm presents an appearance in winter which shows its strength — not the rugged strength of the oak, with its gnarled, irregular branches, but a supple strength suggestive of self-contained reserve force. It is in the winter, too, that the delicacy of the smaller branches is seen to best advantage. Every wind sways

American elm in winter

them but they do not break; they yield gracefully and seem to enjoy the blasts of winter.

Unfortunately the elm is the prey of a tiny insect, which eats the leaves and threatens to destroy the tree entirely in some parts of the country. This little insect, known as the elm leaf-beetle, has damaged thousands and thousands of elm trees during the past few years; and although many persons have worked hard to get rid of it, the pest is continually spreading. The shade trees in towns and cities suffer most, apparently, and it is necessary to act promptly if the elm trees are to be saved. The insect itself is only about one quarter of an inch in length, brownish yellow in color, marked with a dark line along each side of its back. It sleeps during the winter, and the same warm days that bring out the elm leaves awaken this enemy of the elms. The beetles fly to the trees and begin to feed by eating small holes in the leaves. In a very few days the eggs are laid, and these quickly hatch into little grubs which begin in earnest to eat the leaves. So many eggs are laid that the number of grubs at work on the leaves is enormous. In fifteen or twenty days the grubs have completed their growth, and, unfortunately, their work of destruction also. They now crawl down the tree, and by the time another ten days have passed they emerge as fully grown beetles and are ready to repeat the process. Sometimes there are two complete broods of the insects in a single season, but the last brood as a rule does less damage than the first.

The only way to save the elms from this enemy is to spray the leaves with a poisonous liquid. Although it costs twenty-five to sixty cents to have a tree sprayed, it will be necessary to spray our elm trees systematically if we wish to save them. Those who are interested in the work of saving the elms should write to the State College of Agriculture and ask for a copy of Professor Herrick's Experiment Station Circular No. 8, entitled " The Elm Leaf-Beetle."

The next time you are in the woods, see whether you can find any elm trees growing where the woods are thick. If you see any, notice the shape of their trunks and their crowns. Compare them with the trees that grow along the streets in town. What do you think makes this difference in form? Again, if you find any elm trees in the woods, notice the kind of soil in which they grow best. Is it wet or dry? What other kinds of trees are found growing with the elm?

About the last of May or the first of June, watch the elm to see when the seeds begin to fall. Take a few of them and sow them in a garden bed where the soil is soft, rich, and moist. Perhaps you will be able to see the small seedlings grow to a size that will enable them to take care of themselves before winter sets in.

The wood of the elm is useful for purposes demanding great toughness. It is often used in the making of barrels and fruit baskets. It is hard to split and work, and for that reason carpenters do not use it for woodwork or finishing; but if a tough wood is needed, a better wood than that of the elm is difficult to find.

THE PINES OF NEW YORK

John Bentley, Jr.

In the winter months, when most of our forest trees are leafless, the firs, spruces, and pines, with their dark green foliage, are a cheerful sight. It makes us feel, somehow, that after all the woods are not lifeless in winter, and that there are some trees bold and hardy enough to withstand the snow and the cold. Pines are particularly noticeable, because there is more motion and life in their foliage than in the stiff, rigid foliage of spruces and firs. Then, too, pines are more familiar to most of the boys and girls in the State, because spruces and firs belong to the cold climate of the mountains.

White pine

There are five pines that are native to New York State, besides several others that may be found occasionally in our parks. The five native trees are (1) the white pine, (2) the pitch pine, (3) the red, or Norway, pine, (4) the jack pine, and (5) the Jersey scrub pine. The last two are not very common, however, and most of us will find only the three first mentioned.

The pines as a group are marked by three characteristics which all boys and girls should notice first of all. They are: (1) the needle-shaped

leaves, borne in clusters of two, three, or five needles; (2) the cones, in which the little seeds are borne; and (3) the wood, which always contains more or less pitch, or resin. These characters distinguish the coniferous (cone-bearing) trees from the broad-leaved trees. The term "evergreen" should not be applied to the pines, spruces, and firs, because there are other trees, as the holly and the live oak, which retain their leaves throughout the winter and are just as truly evergreen as is the pine or the spruce.

White pine needle cluster

Then, again, there is the larch, about which we learned last year (Rural School Leaflet for September, 1912, page 160), which bears cones and yet sheds its leaves every year. The leaves of the larch are needle-shaped, it bears cones, and there is some resin in the wood, and therefore it clearly belongs to the same family as do pines, firs, spruces, and hemlocks. In order to avoid all confusion, therefore, I would suggest that we learn to call all cone-bearing trees "conifers," which means "cone-bearers." Then let us call the others "broadleaf trees"; this will properly include the live oaks and the holly, and will do away with the confusing term "deciduous" (leaf-shedding) trees. Another term that is frequently heard is "hardwoods." As generally used, this term means the broadleaf trees, although there are some conifers with very hard wood — yellow pine, for example — and some "hardwoods," or "broadleaf" trees, with very soft wood, such as the poplar and the willow. The use of confusing terms should be abandoned and the terms "conifer" and "broadleaf," while sounding a little strange at first, will express our meaning more nearly.

The pines are nearly all of great value because of their wood, which is strong for its weight, straight-grained, and easily worked — that is, carpenters have little difficulty in planing and shaping it to their purposes. Some of the pines have very hard, heavy, resinous wood, as the southern yellow pine; but our northern white pine is light and soft and contains only a moderate amount of resin. The white pine was formerly the most important timber tree of all the northeastern States, and many millions of board feet of white pine have been cut from the forests of New York State within the past century. It is still considered a very valuable tree, and lumbermen are always glad when they can find any white pine to cut because they know that it will bring a good price in the markets.

The white pine is a tall, straight-trunked tree, often reaching a height of one hundred and twenty-five feet in the dense forests of the Adirondack Mountains. When growing in the woods the trunk is frequently clear of all branches for sixty or seventy feet, but when grown in the open,

where it has plenty of room, the crown is broad, with many limbs growing to within fifteen or twenty feet of the ground, and under these conditions the tree never grows very tall. The lumberman likes best of all the tall, straight trees of the forests, for these will yield fine, straight-grained lumber with few knots.

Pitch pine needle cluster

The white pine can be distinguished from the other pines of this State by the needles, which grow *in clusters of five.* Examine the foliage of a pine tree; you will see that the needles, instead of growing singly, grow in bunches, or clusters. In the white pine there are always five needles in a cluster. The individual needles are two and one half to five inches long, slender, flexible, bluish green, with a fine white streak. Let us now look for some cones. We may find some growing on the tree, or we can examine those that have fallen from the tree and are now lying on the ground. The white pine cone is about five inches in length, is usually slightly curved, and is slender, rarely exceeding an inch in thickness. Let us look a little more closely and see whether there are any spines, or prickles, on the cone. If we have picked up a dry cone the seeds have doubtless been shed and scattered. If we can find a fresh cone with seeds in it, we can see how each seed is provided with a thin wing, which enables the wind to blow it for long distances.

Pitch pine

Now let us consider the pitch pine, which is probably the next most common pine tree of this State. It is generally found growing on very poor soils, where only the hardiest trees or shrubs will thrive. This tree can grow in these poor situations because of its thick bark (often two inches thick at the base of the tree) and because it can resist fire much better than can the white pine. It is not nearly so neat in appearance as the white pine; its branches are irregular, the trunk is not so tall and straight, and the old cones frequently hang on the tree for years. The

foliage is stiff and the needles are borne in clusters of *three*; this at once distinguishes it from the white pine. The needles are a dark yellow-green instead of a blue-green. The cones are short and stout, about two or three inches long and two inches thick, and the cone-scales are armed with prickles. There is not the slightest resemblance between the white pine and the pitch pine, either in the needles, cones, or bark; and if you have an opportunity to look at the wood after the tree has been cut, you will find that there is no more resemblance there. The wood of the pitch pine is coarse-grained, full of pitch, and not adapted to the fine work for which white pine is used. Indeed, the wood of pitch pine is of little value except for coarse, rough lumber and for excelsior.

The red pine, or Norway pine, as it is frequently called, is a tree that is not found in many parts of this State. It is common only in the Adirondack region, where it grows on light, sandy soils and has plenty of sunlight. It may be found occasionally, however, in other parts of northern New York. It can be distinguished by its *long, flexible needles* (four to six inches long), which are borne *two in a cluster*. The cones are two to two and one half inches long and *have no prickles*. Taking the cones and the needles together, there is no danger of confusing this tree with the other two pines mentioned.

The red pine reaches a height of seventy-five or eighty feet. The wood is harder than that of the white pine, yet, like white pine, it is not durable in contact with the soil. Because of its hardness it is not so valuable a timber as white pine, but the red pine possesses the great advantage of being a tree that will grow well on land too poor to produce a satisfactory crop of white pine. It rarely makes close forests, because it is a tree that demands a great amount of light for its growth. Red pine trees are never found in large numbers together, at least in this State, but are found mixed with other trees, especially at the edge of lakes or in openings throughout the sandy stretches of country that are common in the Adirondack Mountains.

The jack, or scrub, pine is not frequently seen in this State except in dry, sandy, barren soils in the northern part. It is usually a small, scrubby tree, with irregular branches, and of such poor form that it is practically worthless for lumber. The leaves are bluish green, covered with a gray bloom, and about two inches in length. They are borne in clusters of *two*, are twisted, and have a tendency to spread apart. The cones are small (rarely more than two inches long) and are armed with small prickles, which, however, may drop off.

The Jersey scrub pine is still more irregular and worthless as a lumber-producing tree. It grows in poor, sandy soil and is found growing wild only on Long Island. The needles are borne in clusters of *two* and the cones have prickles.

THE MAPLES OF NEW YORK

JOHN BENTLEY, JR.

The maple family is a large one, containing many trees that are not only useful but also ornamental. In fact, most of the maples are valued chiefly because of their beauty of foliage. About thirteen kinds are considered native to the United States, but by far the greatest number of the maples are native to Asia and the islands bordering that continent. Many of these foreign maples — some of them trees, and some shrubs — have been planted in this country and are common in parks and gardens or along city streets; so that, whether we are in the country or in the city, we are almost sure to see maple trees.

Sugar maple

Maples are noticeable chiefly, perhaps, because of their foliage. Whether we consider the individual leaves of a silver maple or the whole mass of foliage as it appears on a large sugar maple, the leaves are beautiful. The little tender leaves of the soft, or red, maple when they burst from the buds in April are rich and warm in coloring; and what boy or girl who has been in the country during the month of October does not know the brilliant colors for which the maples are famous? The reds, golds, and yellows seem to flood the autumn air with a warmth and light which adds life to it.

Let us make a list of the maples that we may expect to find in New York State, and then add a few descriptive notes regarding them:

1. Sugar, or hard, maple
2. Red, or soft, maple
3. Moosewood, or striped maple (a shrub or small tree)
4. Mountain maple (a shrub)
5. Silver maple
6. Box elder, or ash-leaved maple
7. Norway maple (not native, but commonly planted)
8. Sycamore maple (imported)

Sugar maple

Red maple

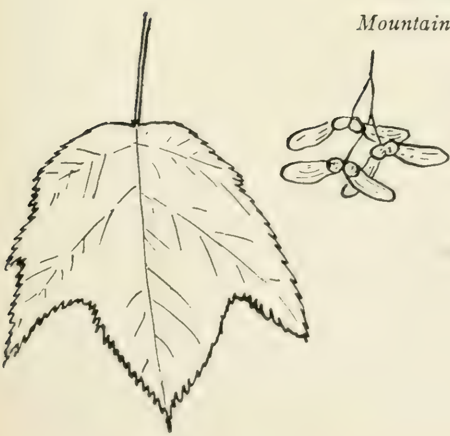
Norway maple

Outline drawings for blackboard work

Box elder

Silver maple

Mountain maple



Moosewood maple

Sycamore maple

Outline drawings for blackboard work

The sugar maple is the largest and finest of the family. In deep woods, where it grows with the beech, birch, basswood, hemlock, ash, and other trees, it often reaches a height of more than one hundred feet, and has a trunk perhaps four feet in diameter which rises straight and full without a limb for more than half the height of the tree. Such a tree is in great contrast to those growing along the roadside, which are shorter and large-crowned and which have so many branches that it is difficult to find any one stem that seems to be the leader. Why does the maple tree growing in the open, where it has plenty of room, form such a round-headed crown, with no well-defined leader? Study the method of branching and see whether you can find out.

The red maple can be distinguished from the sugar maple by its leaves in summer and by its buds in winter. The two kinds are contrasted in the drawings. Note that the lobes of the leaves (of which three are usually very conspicuous) are separated by U-shaped depressions, or sinuses, in the case of the sugar maple, and by V-shaped sinuses in the red maple. The buds of the sugar maple are long, pointed, and of a brown color, while those of the red maple are shorter, rounded, and red in color. These marks will serve as a means of identification at any time of the year. The red maple prefers a wet, swampy soil, while the hard maple thrives in a rich, cool, well-drained soil.

The silver maple has a very beautiful leaf, by which it can always be recognized in summer. Notice, in the drawing, how deeply and finely the leaves are cut; this gives to the tree its peculiar delicacy and makes it desirable for decorative purposes. In fact, the tree is of little use except as an ornament; the wood is soft, weak, and brittle when compared with that of the sugar maple.

The mountain maple and the moosewood (or striped maple) are very humble members of the maple family, rarely growing to be more than shrubs; but they add greatly to the beauty of the woods as we know them in the North. Both these maples are common in the woods of New York, especially in the Catskills, the Adirondacks, and other hilly parts of the State. Favorite situations for these maples are steep, rocky slopes, where there is plenty of moisture, as on the north side of hills or mountains. The leaves are much like the leaves of other maple trees; those of the mountain maple resemble those of the red maple, but the little veins on the former are much more noticeable and the underside of the leaf is covered with a whitish down, which is absent from the red maple. Another character that will serve to distinguish this little maple from the red maple is the seed. The flowers of the mountain maple appear in clusters, which botanists call " racemes "; that is, there are several flowers borne on a central axis and they begin to blossom at the bottom

first. The artist has come to our assistance again, and you will see in the drawing of the seeds that the difference in the fruit is clearly brought out. The red maple bears its seeds in clusters close to the stem.

The moosewood has a leaf that distinguishes it easily from other maples. The leaf is large, with lobes only slightly cut, and is soft in texture. Perhaps the most noticeable character of this tree — one by which the boys will learn to recognize it — is the bark. This is reddish or greenish brown marked with pale stripes running up and down, so that the name "striped maple" is very appropriate. The flowers of this maple also are borne in racemes, so that this feature, together with the striped bark, will always serve to identify it.

The box elder, or ash-leaved maple, is the odd member of the family, for it has leaves totally different from those of the other maples that we know in this country. Instead of a single, simple leaf, this maple has a compound leaf with three to five leaflets. If it were not for the fruit, which is a true maple "key," we should feel more inclined to call it an ash — a feeling that is shown in one of the common names for the tree. The box elder has been used for planting in the treeless regions of the Middle West because it will endure dry weather and will grow rapidly even on relatively poor soils. But the wood is weak and perishable and the tree almost always grows crooked, especially if it is exposed to winds; so that altogether it is not to be considered very valuable.

The Norway maple, which has been planted extensively as a shade tree because of its rapid growth and heavy foliage, is a native of Europe but does very well in this climate. The leaves bear a general resemblance to those of the hard maple, but are much darker in color, usually larger, and thicker. If one is in doubt about the tree, the milky sap from a freshly broken leaf stem will distinguish it. In winter the leaf buds are very large and the bark is smooth and dark-colored.

The sycamore maple, another European tree, is also planted to some extent in this country although it does not grow so well in our climate as does the Norway maple. The leaves are conspicuously three-lobed, and are very broad compared with those of the native hard maple. The margins of the leaves are serrated, somewhat like those of the red maple.

The most valuable and useful of all the maples is the sugar maple. The wood is heavy, hard, and close-grained. It is used for furniture, flooring, and many small wooden articles. It also makes one of the best fire woods that our forests produce. The custom of making sugar and sirup from the sap of this tree is well known and needs no special mention here.

Besides the maples mentioned above, it is likely that many Japanese maples will be found in parks and gardens. These small maples, rarely larger than bushes, are remarkable for the beauty of their leaves.

THE OAKS OF NEW YORK

John Bentley, Jr.

A brave old oak

There are nearly fifty different kinds of oaks in the United States, and if we should include the several varieties, some of which are indistinct, the list would be so long that it would be discouraging to try to learn all of them. Fortunately we can learn to distinguish those that are common in New York. Although there are some fifteen or sixteen kinds of oaks reported as growing in this State, we shall describe but ten. The others are rare or of very local occurrence. It will be necessary to have not only the leaves, but the acorns and sometimes the twigs and the winter buds, in order to distinguish all the oaks described.

In the first place, we can divide the oaks into two general groups: those that have acorns maturing in *one season*, known as the *white oaks*; and those that have acorns maturing in *two seasons*, known as the *black oaks*. A further distinction between these two groups is that the black oaks have leaves the lobes of which are tipped with bristles, while the lobes of the leaves of the white oaks are smooth and rounded. Between the lobes are indentations which botanists call "sinuses." These sinuses are variable and are often a help in identifying the different species. On pages 1232 and 1233 is given a key for identifying the different species of oaks. Note the use of the term *sinus* in this key.

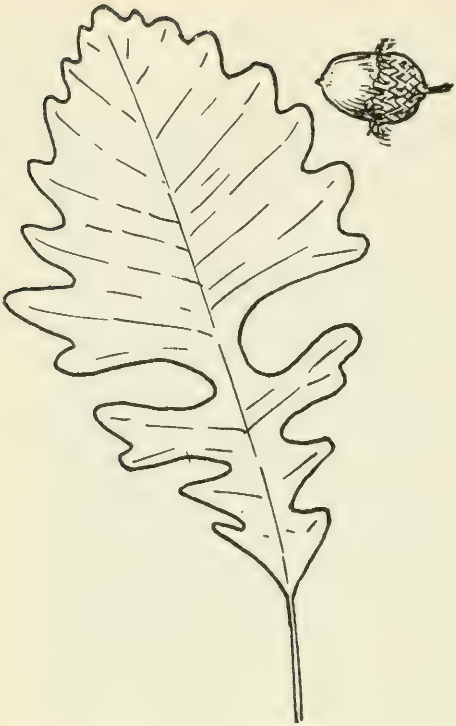
As a family the oaks are very useful; but there is a great difference between the several species, especially as to rate of growth, hardness of wood, and usefulness of wood. In general the white oaks are harder and more durable than the black oaks, and when a carpenter or a wood-worker wants a piece of very hard, heavy, durable wood that will hold its shape without shrinking, warping, or checking, he will be likely to choose a piece of white oak in preference to any other kind of oak. In the market, swamp white oak passes for white oak and sometimes a small quantity of chestnut oak may be included with true white oak; but the wood of chestnut oak is not so strong and good as that of true white oak.

In form the oaks present a great variety. White oak growing in the woods has a long, clear stem for perhaps fifty or sixty feet and reaches a height of over one hundred feet. In the open fields, where it has plenty of room to develop a big crown, the form is likely to be short and round-headed, with a stout trunk and with little of it clear of branches. The oak always presents an appearance of great strength and sturdiness; the winds of winter have little effect on its tough, strong branches but these are frequently gnarled and irregular as a result of exposure to storms. The acorns of the white oak will germinate soon after falling in autumn if the conditions are favorable; but because so many acorns are eaten by squirrels, and because so many others do not find the right conditions of soil and moisture, only a small number succeed in growing to a size that will enable them to live over the first winter.

Although a widely distributed tree, the white oak is found most commonly on good moist soil in rich bottom lands or in protected hollows. In the country adjacent to the Ohio River valley the white oak finds the best conditions of soil, climate, and rainfall. It will grow also on rather dry, stony soil, but it never reaches such good size under these conditions.

Of the black oaks, the common red oak is the most desirable because of the rapidity of its growth and the general quality of its wood. Although not nearly so strong as white oak, it is heavy and rather hard and will be useful where great strength is not required. The grain of the wood is rather coarse and it never seasons so well as does the white oak. In form the red oak develops a very large, wide-spreading crown, with a number of large branches; but it almost always has a well-formed stem, making possible the cutting of good saw logs from it. The red oak grows farther north than any of our native oaks, and is not nearly so particular as the white oak as to quality of soil.

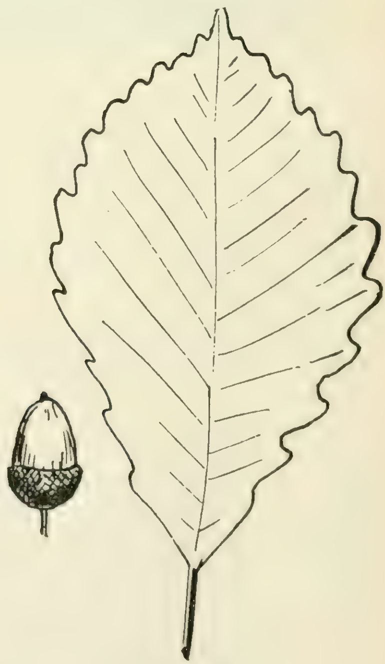
The common black oak is of relatively little importance. The tree does not grow to such good proportions as the red oak and the wood is



Bur oak

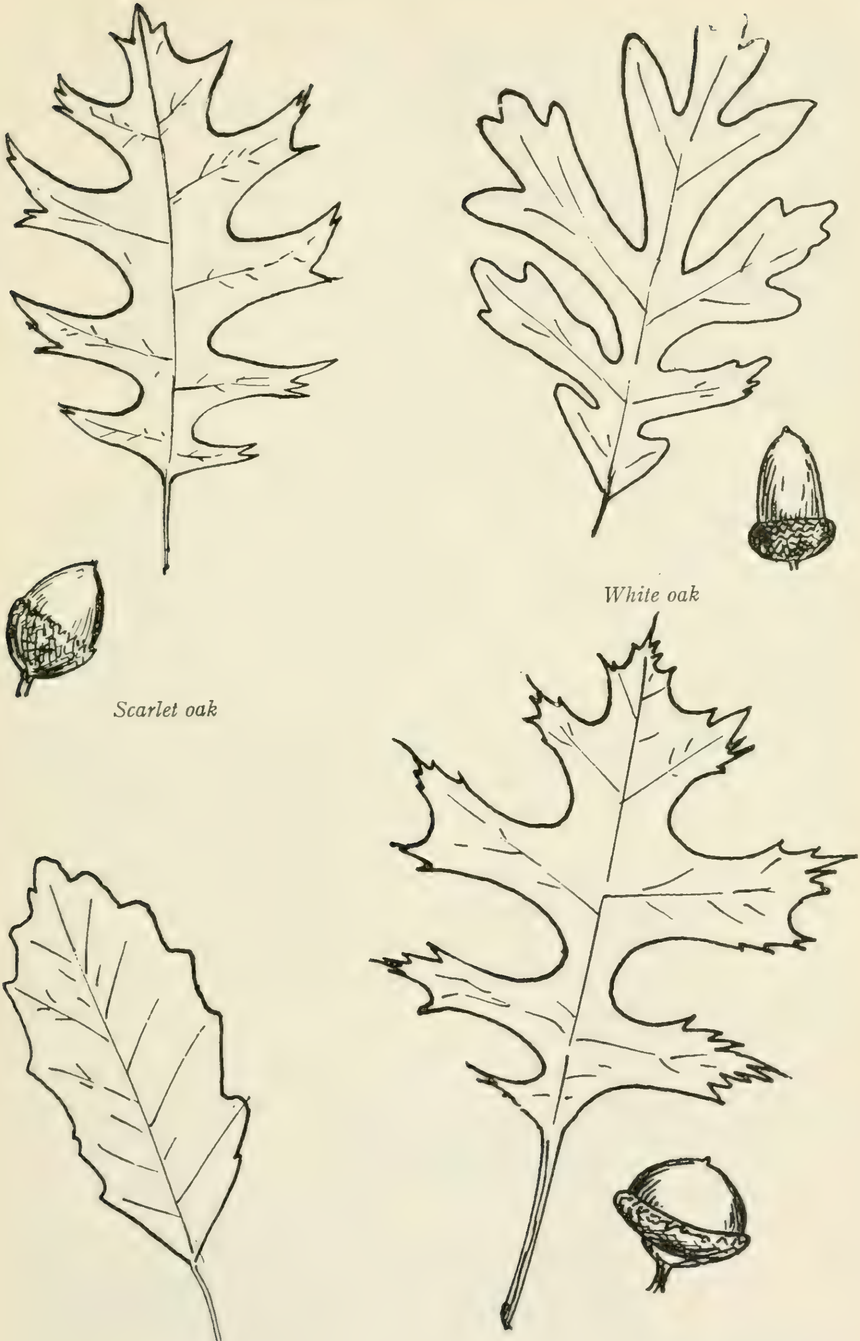
Swamp oak

Post oak



Chestnut oak

Outline drawings for blackboard work



Scarlet oak

White oak

Scrub white oak

Pin oak

Outline drawings for blackboard work

poorer in quality. It is used for railroad ties and rough timbers, but it is not so durable as the red oak.

The scarlet oak is a much smaller tree than either the red or the black oak and it is almost always found growing on sandy or gravelly soils. Its form is not good enough to make it an important timber tree.

The two scrub oaks, which are really little more than shrubs, cover vast areas that have been burned over and are often the obstacle to having better trees on this kind of land. It is better, however, to have them growing on the land than to have nothing at all, for in the latter case the soil might be washed away by heavy rains; and perhaps we shall be able to start more desirable kinds of trees where the scrub oaks are now growing, taking advantage of the protection that they afford.

KEY TO THE COMMON OAKS OF NEW YORK

A. Acorns maturing in one season; leaves with rounded lobes and rounded sinuses.................................WHITE OAKS

1. Margin of leaf merely wavy-toothed, not cut so deeply as to be called lobed
   - (a) Margin finely wavy-toothed...........Chestnut oak
   - (b) Margin coarsely wavy-toothed, more pointed than in (a)...........................Swamp white oak
2. Margin of leaf distinctly lobed; one pair of broad sinuses cutting nearly to the midrib of the leaf, so that the upper part of the leaf is much heavier and broader-looking than the lower part. Acorn with a mossy cup........Bur oak, or Mossy-cup oak
3. Margin of leaf distinctly lobed sometimes very deeply cut, with broad, sinuses
   - (a) Lobes usually seven or nine in number; acorns pointed; cup enclosing not more than one fourth of the nut...................................White oak
   - (b) Lobes usually five in number; acorns not so pointed, and cup enclosing one third to one half of the nut..Post oak

AA. Acorns maturing in two seasons; leaves with pointed, bristle-tipped lobes and rounded sinuses..............BLACK OAKS

1. Leaves green on both sides
   - (a) Sinuses very broad, broader than the lobes between them
     - (i) Acorn small and flat, the nut almost hemispherical. Usually found growing in moist, rich soil on the banks of streams or the borders of swamps.......................Pin oak

(ii) Acorn slightly larger and more nearly round. Kernel whitish. Usually prefers dry soils on ridges and well-drained situations. . Scarlet oak

(b) Sinuses usually not so broad as the lobes between them

(i) Leaves thick and firm; dark green, lustrous above; more or less fuzzy on the underside. . . . . Black oak

(ii) Leaves thin and firm; dark, dull green above; on the lower side usually smooth, or with fuzzy hairs near the veins only. . . . . . . Red oak

Or by their acorns these two oaks can be distinguished as follows:

Cup very flat, saucer-shaped. . . . . . Red oak

Cup not so flat, enclosing nearly half the nut. . . . . Black oak

2. Leaves green above, gray-green or yellowish green and scurfy on the lower side; usually with only three lobes. (Found only on Long Island). . . . . Blackjack

"What does he plant who plants a tree?
He plants a friend of sun and sky;
He plants the flag of breezes free;
The shafts of beauty towering high;
He plants a home to heaven anigh,
For song and mother-croon of bird
In hushed and happy twilight heard —
The treble of heaven's harmony —
These things he plants who plants a tree."

HENRY CUYLER BUNNER

"The cattle also are very glad of a great tree,
They chew the cud beneath it while the sun is burning,
And there the panting sheep lie down around their shepherd.

"He that planteth a tree is a servant of God,
He provideth a kindness for many generations,
And faces that he hath not seen shall bless him."

HENRY VAN DYKE

OTHER TREES TO BE RECOGNIZED IN 1913–1914

JOHN BENTLEY, JR.

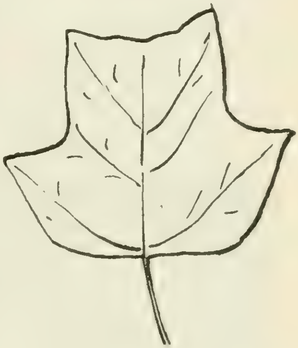
The balsam fir.— The balsam fir, which is given for study this year, is one of the most attractive of conifers. It is prized because of the odor that comes from the aromatic gum in its leaves and buds. It resembles the Norway spruce, but can be easily distinguished from the latter as follows:

Balsam fir

Norway spruce

	Balsam fir		*Norway spruce*
Bark	Light gray; blisters which contain resin, called Canada balsam, on bark;	Bark	Reddish gray; no resin blisters
Cones	When young, dark purple; later, brown. Stand erect on branch	Cones	Long, light brownish yellow. Hang down on branches
Needles	Flat; a light gray streak on the underside	Needles	Four-sided

The tulip tree.— This is one of the stateliest and most magnificent of all our native American trees. In the southern mountains, where it reaches its finest development on rich, moist soils of protected slopes, it is not uncommon to find the tulip tree (or yellow poplar, as it is called there) growing to a height of one hundred and sixty feet and a diameter of six feet. Its trunk is often so straight and clear of limbs that a large amount of valuable lumber is obtained from a single tree. Notice the leaves of the tulip tree as shown in the drawing; did you ever see a leaf that resembled this at all? Probably not, for this tree is one of two species which are relics of ancient times. The other species is found in China.



Leaf of tulip tree

The beautiful flowers of the tulip tree appear immediately after the leaves unfold. They resemble tulips, from which fact the tree takes its name, but they do not last long. The fruit looks somewhat like a cone. The seeds that it bears are unfortunately very poor in vitality, so that, although many seeds may be distributed by the tree, only a few germinate and the tulip tree is therefore not so common as we should like to have it. Wherever it is found it should be protected and encouraged.

The tulip tree yields a very high grade of lumber. It is soft, easily worked and unusually free from knots. It is much used for interior finish. Much of the timber has been exported to Europe from even the most inaccessible parts of the southern mountains, the wide boards from large trees being in great demand.

The juniper.— The juniper is distinguished from all other conifers by its fruit, which is a berry. The blue berries of our common juniper, or red cedar as it is frequently called, are a familiar sight. The tree is very slow-growing, but it can be grown on poor, sterile soils where nothing else will thrive. The juniper, which is common in rocky pastures, rarely has an opportunity to grow more than thirty or forty feet tall, for long before it attains its full size it is cut down for fence posts or other useful purposes. A southern form of this cedar was formerly very extensively used in the manufacture of lead pencils, but it has become so scarce of late years that other and cheaper woods have been substituted for it. The wood of the juniper is light, easily worked, and very aromatic. The odor, which is so pleasant, is distasteful to insects, and this renders the wood proof against their attacks. The wood is also very durable when in contact with the soil. For these reasons cedar is used largely for fence posts and for the manufacture of chests in which to keep woolen clothing.

The dogwood.— This small tree, which is of little use in the way of timber, is a beautiful sight in May when the flowers appear. The large, white, showy "flowers," so-called, are not the true flowers, but are really floral leaves surrounding the true flowers, which are relatively inconspicuous. This tree never occurs in great numbers, but it is found scattered throughout the woods and always occupies a humble position. The opposite, wavy-margined leaves, which have prominent veins, are a means of recognizing the trees in summer; while the pointed terminal buds form a mark by which the tree may be distinguished in winter. The wood is hard and close-grained, and takes a fine polish; for this reason it is used sometimes for tool handles or other turned articles, for

Dogwood

the hubs of small wheels, or for engravers' blocks. The fact that the tree never attains a large size prevents its becoming generally useful, and it is therefore prized chiefly for its ornamental qualities.

*The sumac.**— The staghorn sumac is a large shrub, with velvety-hairy branches. The fruit, or seed part, is terminal — that is, on the ends of the branches — and is composed of a dense cluster of red, hairy berries.

Smooth sumac is often a large shrub, but the branches are smooth. The fruit is terminal, like that of the staghorn sumac, but it does not make such a stiff, dense cluster.

Poison sumac, or poison elder, is also a large shrub, but it grows only in swamps or moist places. The twigs are mottled brown-and-gray. The

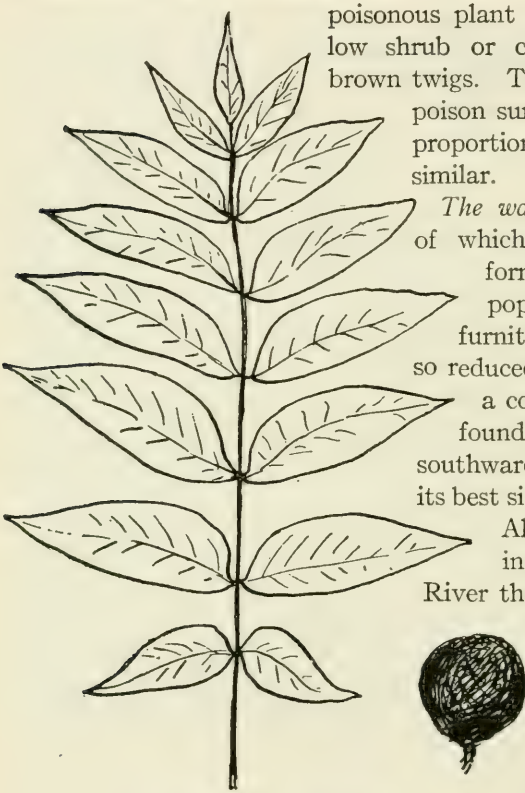
*We are indebted to Ralph W. Curtis for the material on the sumacs.

fruits are round, waxy berries (dry and hard in winter), borne in loose, slender clusters which, instead of being terminal, are axillary, that is, growing out of the sides of the branch in the axils of the leaves. If the leaves have fallen the leaf scars are still there and are big and broad, not narrow and circular like those of the staghorn sumac.

Fruit and twigs of the common sumacs: 1, staghorn; 2, fragrant sumac; 3, poison ivy; 4, smooth sumac; 5, poison sumac

Fragrant sumac is a low shrub. The fruit is in small clusters of red hairy berries which fall off early in winter. The small clusters on the present twigs are next year's flowers, which open very early in spring before the leaves. The wood is sweet-scented.

Poison ivy, or poison oak (a true sumac and by far the most common poisonous plant in the United States), is a low shrub or climbing vine, with light brown twigs. The fruit is like that of the poison sumac, and the leaf scars, in proportion to the twig, are also similar.



Leaf and fruit of walnut

The walnut.— This tree, the nuts of which are familiar to all, was formerly abundant. Its great popularity as a wood for fine furniture and cabinet-making has so reduced the supply that it is now a comparatively rare tree. It is found from central New York southward to Florida, but it reaches its best size on the western slope of the Allegheny Mountains. It was in the region of the Ohio River that most of the fine walnut was cut a number of years ago, and it is still occasionally found there on rich, mellow soil in protected situations. So valuable has it become that in some places lumbermen are going back after the stumps of the trees that were cut years before, digging them up and making veneers from them.

In earlier days walnut was much used for fence rails. As the wood is very durable, old rails may be sound, and in some sections even these old rails have been used in the manufacture of small products.

A peculiarity of the walnut tree which is a serious matter when making plantations is the fact that even the one-year-old tree has a very long tap-root. It is difficult to transplant trees that are several years old, and whenever possible the necessity of transplanting should be avoided by planting the nuts where the trees are to remain permanently.

THE PLUM

H. B. Knapp

THE plum is one of our most difficult fruits to study—difficult from the fact that the species and varieties of this tree are so numerous and so mixed by crossing that it is almost impossible to describe and classify them satisfactorily.

This is perhaps one of the least popular of our tree fruits. The fruit is used largely for canning, and in certain parts of the United States the drying of one type of plum, the prune, has become an industry of considerable importance. We commonly speak of the prune as being a more or less distinct fruit, but in reality it is a plum with flesh thick enough and firm enough to give a satisfactory product when dried.

Almost all our cultivated plums have come from Europe, although their native home was probably western Asia. Among these plums may be mentioned Lombard, Reine Claude, Bradshaw, and the Damsons. The Japanese types of plums are also grown largely now, but these varieties are of only fair quality. The quality is usually improved greatly by severe thinning of the fruit, because the trees are likely to over-bear. Two of the most common varieties of Japanese plums are Abundance and Burbank. In addition to the plums mentioned here there are many other types and species, some of them native to this country. These native plums apparently afford an important field for the improvement of our present-day varieties both in quality and in hardiness, and indeed it will not be surprising if future generations develop them to such an extent that they largely replace those which have come to us from other lands.

The plum will succeed on a fairly heavy soil, but the soil should not be a wet one. A good pear soil is in many respects a good plum soil, while the soil which is most favorable for the growing of peaches is a little lighter than that on which most varieties of plums thrive best. The Japanese varieties prefer a lighter soil than do the other varieties. The axiom which might be laid down, that fruit trees should never be planted in sod or on sod ground, holds true in regard to the plum. Next to the cherry it will thrive in sod better than will other tree fruits, but this does not mean that the plum will not respond to proper treatment when it receives it. The land, then, should be used for some tilled crop the previous year, in order that the sod may have an opportunity to decay partially before the tree is set.

The plum is commonly planted in spring, although in milder sections of the State it may be planted with safety in the fall provided the land

is well drained and the trees are mature when dug at the nursery. Both one- and two-years-old trees are used, although most of them are of the latter age.

The distance of planting will vary somewhat with the varieties and with the richness of the soil. The trees should not be much closer than twenty feet. The grower is more likely to set them too close than too far apart. Pruning the first year will consist of removing all but three or four branches that are so distributed as to make a well-balanced top. These branches will later become the framework of the head of the tree. The plum does not require as much pruning as do some of our other fruits, nevertheless attention should be paid to this factor each year. If done properly and if the branches are taken out when they are small, little pruning will be necessary when the tree reaches maturity. The land should be worked with a plow or a harrow in the same manner as it is worked for other orchard fruits.

Most of the plums bear fruit on wood that is over one year of age, usually on two-years wood or older. Fruit buds are formed on dwarf branches, known as fruit spurs. The Japanese varieties, however, and to a certain extent some of the other varieties, bear fruit from buds on one-year wood. It is usually well to thin the fruit, as the plum is likely to over-bear.

The most serious pest of the plum is the curculio, which stings the fruit, causing it to drop to the ground. This may be partially controlled by deep cultivation in July and August, which helps to destroy the insect while it is passing part of its life in the ground; but a better means is to thoroughly spray with arsenate of lead, six pounds to one hundred gallons of water, just as the shucks, or withered blossom parts, are falling from the fruit.

The average life of the plum tree is in the neighborhood of twenty-five to thirty years, although it will live longer if grown under conditions that are especially suited to it. There are many varieties of plums that succeed in New York State, but it is always best to plant the varieties that are known to succeed well under the local conditions. Among the most popular and satisfactory varieties are: Bradshaw, Reine Claude, Italian Prune (or Fellenburg), Duane, Lombard, Shropshire Damson, and Grand Duke. The Damson plums are used for preserves and the like. Two of the most widely grown Japanese plums are Abundance and Burbank. The Abundance is preferable for the home garden, but neither of these varieties is entirely hardy in the colder sections of the State.

Some variety of plum can be grown in nearly every part of New York State. The essential factor to be kept in mind is to choose the varieties best adapted to the conditions under which they are to be grown. It is

much better to consult with a neighbor who is growing plums successfully than to heed the advice of the tree agent. The former has no object in misleading you, the latter may or may not have.

THE PEACH

H. B. KNAPP

The apple has been called the king of fruits, and justly so because of its popularity and widespread use. If the apple deserves this title, then the peach is just as surely the queen of fruits, possessing the qualities of beauty, tenderness, and luscious flavor to a degree which no other of our northern fruits can boast. It is an old, old fruit, originating either in Persia or, more probably, farther eastward. The species name "Persica," to which this fruit belongs, is derived from Persia, where it was long thought that the peach was first grown. There are several groups of peaches now grown in this country, just as there are several groups of cherries. These groups differ in the size, shape, and flavor of the fruit and in the manner of growth of the tree. Only two of these groups are of commercial importance in New York State: the North China group, to which the Elberta belongs, and the Persian group, of which the Crawford is an example.

The peach is the tenderest of all our commercial fruits. It can be grown with the greatest success only in the more favored sections of the State, namely, those regions in which the climate is tempered by nearness to large bodies of water. For example, the Ontario Lake region of New York State is recognized as one of the foremost peach-growing sections in this country. This does not mean that the peach may not be grown in less favored sections of the State, but it does mean that it will require more attention in those parts because it is not naturally adapted to them. On the whole, to grow this fruit successfully requires more care and skill than to grow any other of the orchard fruits. It is very susceptible to cold, to fungous diseases, and to the attacks of insects. It is wholly intolerant of sod or grass, and, unlike the cherry, it is a decided failure when planted in an out-of-the-way corner of the garden and left to shift for itself. The peach will thrive in proportion to the care bestowed on it, for, while some fruits will thrive in spite of lack of management by the grower, this is not true of the peach.

The peach is grown on a variety of soils, and we know more definitely the types on which it succeeds best than in the case of any other fruit. A soil that is light and warm, such as a sandy or gravelly loam, gives best results. The peach does not relish a wet soil, and those just mentioned are, of course, well drained by nature. The peach is sometimes

grown on heavy soils, but the fruit is less likely to mature at the proper season. In addition, the tree often makes wood growth at the expense of its fruit-bearing habit, and frequently the buds are not mature when cold weather sets in.

The best time to plant the peach is in the spring. If planted in the fall it is very likely to succumb to the cold of winter. The land, which should have grown a cultivated crop the previous year, should be plowed and put into condition for planting just as early in spring as possible; for the earlier the tree is set, the better is its opportunity to become established before dry weather arrives. The trees are commonly set twenty feet apart, although at the present time many fruit-growers are planting them twenty-two feet apart. The peach tree is always set when one year old. At this age it will be four to six feet tall, with a number of side branches. These branches are usually pruned off when the tree is set, and the top is cut back to three feet or less in height. The peach is headed much lower than are other tree fruits; and the closer to the ground we desire the head, the shorter should be the whip that we leave when pruning. The top is usually cut back and thinned out rather severely each year, as the productivity of the tree depends on the stimulation of new growth.

All the fruits thrive best if given good cultivation, but none is such an absolute failure when left in sod as is the peach. In this condition the vitality of the tree is so weakened that it becomes an easy prey to insect enemies and fungous diseases. The life of the peach tree is short at best, being about twelve years, but if grown in sod it will not last more than five or six years.

The ground about the trees should be plowed in early spring and cultivated every week or ten days until late July or early August. At this time a cover-crop should be sown, to remain on the ground during the ensuing winter and to be plowed under in the spring. This cover-crop may be rye, vetch, or some of the clovers. The cover-crop affords one of the most inexpensive means that we have of furnishing fertilizer to the trees, and in some cases it may furnish all the plant-food necessary if the land is rich naturally. Oftentimes, however, commercial fertilizers are needed in addition, chiefly phosphoric acid and potash. The amounts to be applied can be determined only by actual experiment.

The peach tree begins to bear fruit when three years old, the average yield at that time being about one third of a bushel. With good care the yield will usually increase until the tree is ten years old. At this time the production of each tree will be in the neighborhood of three bushels. These figures will, of course, vary with the varieties and the conditions under which the fruit is grown. The fruit-bearing habits

of the peach differ from those of other tree fruits in that all the fruit is borne on wood of the previous season's growth. This is sometimes called one-year wood. The upper and lower parts of the previous season's growth usually contain single buds. These are leaf buds. In the central part of the branch, however, the buds are generally in clusters of three. The central buds of these clusters are always leaf buds, while the outer ones are fruit buds, each containing a single blossom. It is often the case that only a small proportion of these buds develop sufficiently to bear fruit. It is well that this is so, because if all the fruit buds that form each year were to produce fruit the trees would be overloaded and considerable time and money would have to be expended in thinning the fruit. Even as it is, the growers of fancy peaches practice thinning the fruit each year.

It will probably be necessary to spray the peach. Insects and diseases will vary with the different sections and with the conditions under which the fruit is grown. For information on these subjects, a publication devoted to their treatment should be consulted.

It is not possible to recommend varieties for planting with any assurance that they are the best varieties for the purpose, without first knowing the conditions under which they will be grown. Persons are likely to feel that those fruits which are grown at a considerable distance and are unknown in their own community are superior to those found at home; but the safer way is to plant those varieties that have proved suitable for local conditions.

The peach is one of our finest fruits and should be found in every home garden where the tree will grow. It will not thrive without care, but it will repay the caretaker for the time spent on it.

"I watch the snow-flakes as they fall
On bank and brier and broken wall;
Over the orchard waste and brown,
All noiselessly they settle down,
Tipping the apple boughs and each
Light quivering twig of plum and peach."

J. T. TROWBRIDGE

PART II

In the following pages will be found suggestions and helps for teaching country-life subjects, which may be of use to teachers. Special request has been made for some of the material. Attention is called to the message of the President of the New York State Teachers' Association, pages 1279–1280.

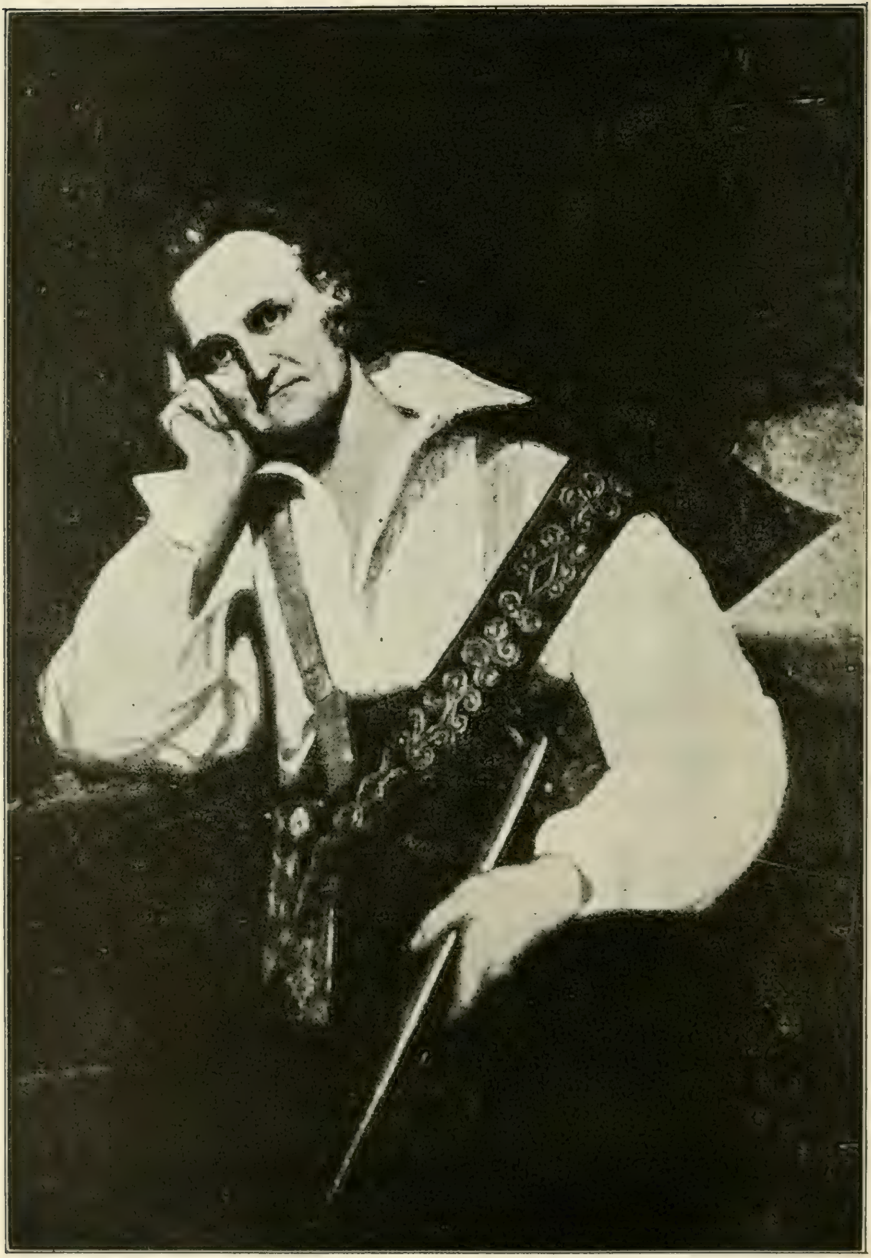
MY PURPLE HILLS

L. H. Bailey

Far over the valley are purple hills
  Afloat in a twilight of haze;
I think there are fountains and falling rills
  And aisles a-dream in th' forest ways;
I think there are birds with a song that thrills
  And winds that roam in th' quiet days.

But the space between has a deep morass
With tangles and bogs that I fear to pass;
There are quaking hollows and sinking sands
And white burning suns on the sterile lands;
There are bottomless streams with luckless shores
And hedges of briars on the log-piled floors;
Blind depths I must cross and cliffs I must scale
That stand like walls in the dread intervale.

Yet I think that I see the falling rills
  In the depths of the twilight bar,
And I listen to catch the song that thrills
  Falling down from the aisles afar;—
I am journ'ying on to my purple hills,
  And over the hills is a star.



JOHN JAMES AUDUBON

AUDUBON

THE EDITORS

Boys and girls in rural districts should know something of the famous naturalists and the contributions that they have made to out-of-door literature. During the past two years the life and works of Henry D. Thoreau and of John Burroughs have been of interest to many young persons in New York State. This year some profitable hours may be spent in considering the life of John James Audubon and his valuable work. Nearly every child in the State has heard of the Audubon Society; but how many know very definitely who Audubon was and what he did?

A most charming presentation in brief of Audubon's life is given in a volume entitled "John James Audubon," edited by M. A. DeWolfe Howe, with introduction by John Burroughs. This is published by Small, Maynard & Co., Boston, and costs 50 cents net; by mail, 55 cents. The older boys and girls will be much interested in the book and it will make a valuable addition to the school library.

In this leaflet we have space for only a few words concerning the great naturalist, chief of American ornithologists. He was born in May, 1780, in Mandeville, Louisiana, and died in January, 1851, in New York. He spent the greater part of his long life in search of a knowledge of birds and in preparing drawings and gathering information concerning bird life and other animal life for publication. Mr. Howe speaks of him as follows:

"As a youth Audubon was an unwilling student of books; as a merchant and mill owner in Kentucky he was an unwilling man of business, but during his whole career, at all times and in all places, he was more than a willing student of ornithology — he was an eager and enthusiastic one. He brought to the study of birds and of open-air life generally, the keen delight of the sportsman, united to the ardour of the artist moved by beautiful forms.

"He was not in the first instance a man of science, like Cuvier, or Agassiz, or Darwin — a man seeking exact knowledge; but he was an artist and a backwoodsman, seeking adventure, seeking the gratification of his tastes, and to put on record his love of the birds. He was the artist of the birds before he was their historian; the writing of their biographies seems to have been only secondary with him."

In the introduction to Mr. Howe's work on "John James Audubon," John Burroughs gives the following information in regard to the great ornithologist:

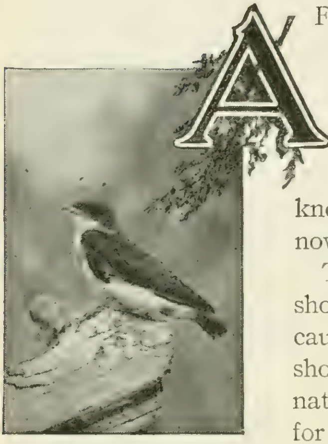
"Audubon was blessed with good health, length of years, a devoted and self-sacrificing wife, and a buoyant, sanguine, and elastic disposition. He had the heavenly gift of enthusiasm — a passionate love for the work he set out to do. He was a natural hunter, roamer, woodsman;

as unworldly as a child, and as simple and transparent. We have had better trained and more scientific ornithologists since his day, but none with his abandon and poetic fervor in the study of our birds."

COUNTRY LIFE TEACHING

THE POINT OF VIEW *

L. H. BAILEY



A FUNDAMENTAL necessity to successful living is to be in sympathy with the nature-environment in which one is placed. This sympathy is born of good knowledge of the objects and phenomena in the environment. The process of acquiring this knowledge and of arriving at this sympathy is now popularly called nature-study.

The nature-study process and point of view should be a part of the work of all schools, because schools train persons to live. Particularly should it be a part of rural schools, because nature-environment is the controlling condition for all persons who live on the land. There is no effective living in the open country unless the mind is sensitive to the objects and phenomena of the open country; and no thoroughly good farming is possible without this same knowledge and outlook. Good farmers are good naturalists.

For many years it has been one of the purposes of the College of Agriculture in New York to point the way to this nature-sympathy: and, inasmuch as this nature-sympathy is fundamental to all good farming, it was conceived that the first duty of any movement was to lend the effort to the establishing of an intelligent interest in the whole environment — to knowledge of fields and weather, trees, birds, fish, frogs, soils, domestic animals. It would be incorrect to begin first with the specific agricultural phase of the environment, for the agricultural phase (as any other special phase) needs a foundation and a base: it is only one part of a point of view. Moreover, to begin with a discussion of the so-called "useful" or "practical" objects because they are practical, as many advise, would be to teach falsely; for, as these objects are only part of the environment, to single them out and neglect the other subjects would result in a partial and untrue outlook to nature; in fact, it is just this partial and prejudiced outlook that we need to correct. But because certain objects and subjects are "practical" is of course no reason why they should be avoided. The web of life is woven of many strands.

*Reprinted, with modifications, from the September, 1912, Rural School Leaflet.

In our own effort, we have always had in view the agricultural aim or application. We should have been glad if there had been sufficient nature-study sentiment to enable us to confine our particular work to the agricultural aim; but this sentiment had to be created or quickened, and we have tried to contribute our part toward accomplishing this result. At first it was impossible to gain much hearing for the agricultural subjects. Year by year such hearing has been more readily given, and the work has been turned in this direction as rapidly as the conditions would admit — for it is the special mission of an agricultural college to extend the agricultural applications of nature-study. In later years the content of the work has had very direct relation to farm-life questions. The time has now come, we think, when we can devote practically all our energies to this application. It is the purpose of this leaflet to aid the teacher in the rural school to work out the practical daily problem of teaching agricultural subjects.

In doing this, we merely confine oursleves to our more special field. The general nature-study outlook is fundamental, and we shall continue to emphasize it; but we feel that the appreciation of this outlook is now so well established as to allow us to specialize. The State Education Department has issued syllabi for agriculture and nature-study; we desire to be useful in applying them to the conditions and needs of country life. Schools here and there are ready for agricultural work; we want to help.

In making these statements we have in mind that the common schools do not teach trades and professions. We do not approach the subject primarily from an occupational point of view, but from the educational and spiritual; that is, the man should know his work and his environment. The mere giving of information about agricultural objects and practices can have very little good result with children. The spirit is worth more than the letter. Some of the hard and dry tracts on farming would only add one more task to the teacher and the pupil if they were introduced to the school, making the new subject in time as distasteful as arithmetic and grammar often are. In this new agricultural work we need to be exceedingly careful that we do not go too far, and that we do not lose our sense of relationships and values. Introducing the word agriculture into the scheme of studies means very little; what is taught, and particularly how it is taught, is of the greatest moment. We hope that no country-life teaching will be so narrow as to put only technical farm subjects before the pupil.

We need also to be careful not to introduce subjects merely because practical grown-up farmers think that the subjects are useful and therefore should be taught. Farming is one thing and teaching is another.

What appeals to the man may not appeal to the child. What is most useful to the man may or may not be most useful in training the mind of a pupil in school. The teacher, as well as the farmer, must always be consulted in respect to the content and the method of teaching agricultural subjects. We must always be alert to see that the work has living interest to the pupil, rather than to grown-ups, and must be on guard that it does not become lifeless. Probably the greatest mistake that any teacher makes is in supposing that what is interesting to him is therefore interesting to his pupils.

All agricultural subjects must be taught by the nature-study method, which is: to see accurately; to reason correctly from what is seen; to establish a bond of sympathy with the object or phenomenon that is studied. One cannot see accurately unless one has the object itself. If the pupil studies corn, he should have corn in his hands and he should make his own observations and draw his own conclusions; if he studies cows, he should make his observations on cows and not on what some one has said about cows. So far as possible all nature-study work should be conducted in the open, where the objects are. If specimens are needed, let the pupils collect them. See that observations are made on the crops in the field as well as on the specimens. Nature-study is an outdoor process: the schoolroom should be merely an adjunct to the out-of-doors, rather than the out-of-doors an adjunct to the schoolroom, as it is at present.

A laboratory of living things is a necessary part of the best nature-study work. It is customary to call this laboratory a school garden. We need to distinguish three types of school garden: (1) The ornamented or planted grounds; this should be a part of every school enterprise, for the premises should be attractive to pupils and they should stand as an example in the community. (2) The formal plat-garden, in which a variety of plants is grown and the pupils are taught the usual handicraft; this is the prevailing kind of school-gardening. (3) The problem-garden, in which certain specific questions are to be studied, in much the spirit that problems are studied in the indoor laboratories; these are little known at present, but their number will increase as school work develops in efficiency; in rural districts, for example, such direct problems as the rust of beans, the blight of potatoes, the testing of varieties of oats, the study of species of grasses, the observation of effect of fertilizers, may well be undertaken when conditions are favorable, and it will matter very little whether the area has the ordinary "garden" appearance. In time, ample grounds will be as much a part of a school as the buildings or seats now are. Some of the school-gardening work may be done at the homes of the pupils, and in many cases this is the only

kind that is now possible; but the farther removed the laboratory, the less direct the teaching.

The school should reflect the work and the needs of its community. If the community is pastoral — and all rural communities are pastoral — then the school should have a pastoral sentiment and feeling. Actual farm experience has great power in the training of the young. We had not realized how much real value it has until we measured the inadequate results of much of the city experience and of much of the formal traditional school work. We are now to catch up these rural experiences and practices into a working plan of education, and we shall make the open country a real background of school work. We are all experimenting with the subject now if not even playing with it, but it is becoming more real and in time we shall have a genuinely pastoral motive running through the schools. The out-of-doors is the background of civilization.

In order to introduce agriculture into any elementary rural school it is first necessary to have a willing teacher. The trustees should be able to settle this point. The second step is to begin to study the commonest and most available object concerning which the teacher has any kind of knowledge. The third step is to begin to connect or organize these observations into a method or system. This simple beginning made, the work should grow. It may or may not be necessary to organize a special class in agriculture; the geography, arithmetic, reading, manual training, nature-study, and other work may be modified or re-directed. It is possible to teach the state elementary syllabus in such a way as to give a good agricultural training.

In the high school the teacher should be well trained in some special line of science; and if he has had a course in a college of agriculture he should be much better adapted to the work. Here the teaching may partake somewhat more of the laboratory method, although it is possible that our insistence on formal laboratory work in both schools and colleges has been carried too far. In the high school, a separate and special class in agriculture would better be organized; and the high school syllabus of the State Education Department provides for this.

In all agricultural work in the schools of the State, the College of Agriculture desires to render all the aid that it can. Correspondence is invited on the agricultural questions involved. In special cases an officer of the College may be sent to give advice on the technical agricultural phases of the teaching. Considerable literature in the publications of the College is now available and will be sent on application.

In many districts the sentiment for agricultural work in the schools will develop very slowly. Usually, however, there is one person in the community who is alive to the importance of these new questions. If

this person has tact and persistence he should be able to get something started. Here is an opportunity for the young farmer to exert influence and to develop leadership. He should not be impatient if results seem to come slowly. The work is new; it is best that it grow slowly and quietly and prove itself as it goes. Through the grange, reading-club, fruit-growers' society, creamery association, or other organization the sentiment may be encouraged and formulated; a teacher may also be found who is in sympathy with making the school a real expression of the affairs of the community; the school premises may be put in order and made effective; now and then the pupils may be taken to good farms and be given instruction by the farmer himself; good farmers may be called to the schoolhouse on occasion, to explain how they raise potatoes or produce good milk. A very small start will grow by accretion if the persons who are interested in it do not lose heart, and in five years every one will be astonished at the progress that has been made.

MANUAL TRAINING BY MEANS OF AGRICULTURE*

L. H. BAILEY

Now that the interest in agricultural education is so widespread, it is essential that we consider some of the underlying or background problems.

The education of the young should be founded in personal experience and not alone in formal school work. In years gone by, the child and youth acquired personal experience in the domestic duties of the home, in working on farms and in shops, and in many other ways. The social, economic, and domestic relations have now so much changed that the child is not likely to be a real cooperator and partaker in the responsibilities of home and work. This change is not marked on the farm, however, and for this reason the farm youth has the advantage of a start in life that is worth more than any exclusive book training. In the old days the "book-learning" of the schools was a supplement and complement to the active handwork of the home. This handwork having now been eliminated to a large extent, the school work does not have the proper foundation, with the result that it often remains exotic.

The schools are now making an effort, with more or less success, to meet the home deficiencies. Various plans of manual work and training are established. In the so-called manual arts and mechanics this development has taken place most effectively. It has not yet developed to any extent in the utilization of agricultural labor and occupation.

*From an address given at a meeting of the New York State Teachers' Association held in Buffalo, November 28 to 30, 1912.

I wish it were possible that no youth were ever allowed to graduate from a high school until he had performed real and useful manual labor over a considerable period of time. Such experience would ripen him. I wish this might be as true of the training of girls as of boys. If this were a condition of high-school work it would be equally a condition of college work. I know this is not possible; but I think we may well set it before ourselves as an ideal, and endeavor to reach it as nearly as possible by substituting institutional work for the lack of home work.

Of course, such substitution cannot produce as genuine results in a given length of time as real labor in the home and with the parents, but it would be a vast improvement over the present method of allowing the boy and the girl to go through all the grades of the public school and then through college, and perhaps even on to graduate studies, without ever having had any useful occupational experience in life. Every person in the world should be able to do something with his hands as well as with his head.

The colleges and schools of agriculture are now confronted with very serious problems touching the qualifications of those who enter the institutions. Many of their students are coming from the cities and towns without any practical experience of farm life or any personal knowledge of the rural background. One cannot gain this knowledge or experience by reading about it or dreaming of it. He must actually have been a part of a country community in order to understand the situation. It is impossible, however, to impose a general entrance requirement in farm practice, because no way is provided whereby this experience can be gained, if one is not brought up on a farm.

A certain number of town boys can find employment on farms, but the opportunities in this direction are not sufficient to meet the necessity or the demand. Most farmers do not want city boys. I have many times appealed to farmers that they owe a duty to the community to take pains with the young man who comes to them for instruction, considering him as a pupil and paying him what his labor is worth, or charging him for instruction, if he earns nothing, and for any damage that he may do. The number of farmers who are in position and able to do this is limited. Many city youths are adaptable and make excellent farm help; but all inexperienced youths should be looked on as learners. Herein is a relationship that needs adjustment. In some way society must provide the means whereby some of this needful experience may be gained, if society is to maintain schools and colleges for agricultural education.

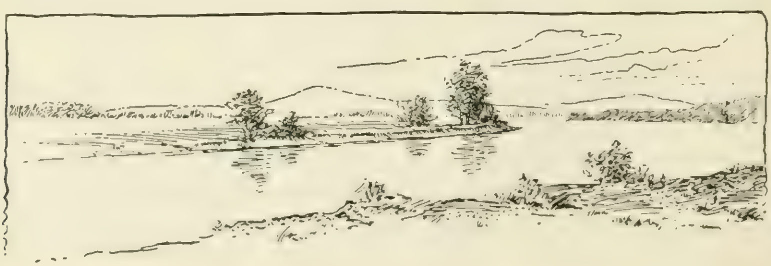
If a college imposes an entrance requirement of mathematics, the candidate has an opportunity in the public schools to get his preparation in that subject. The same is true in history, language, and sciences. It is

not true in the manual experience that one needs just as much before he enters college.

The State of New York has now undertaken to maintain advanced education in agriculture by the establishment of a state college and several schools. It should now go back to the beginning and provide the preparatory agencies. The first essential is to make it possible and practicable for public schools to introduce agricultural subjects on similar terms with other subjects; and this is now being actively, and I think effectively, undertaken. If the State is to provide the best complete enterprise, the next most important need is some kind of direct training-school opportunity in agriculture. Apparently, some of the European countries have distanced us here.

These manual and training schools may be connected with existing public schools or they may be separate units; but I think they all should be very closely connected with the state education policy, not form a duplicate system. By eliminating the purposeless long vacation and maintaining a twelve months' enterprise, such training schools or classes might be combined with the existing public schools without loss of time to the pupil. These training schools or training classes should be many, in order to meet the needs of the different localities. They should be small units and strictly limited in the number of pupils, so that each pupil might receive the maximum of actual hand training. The course of study should be a training-school method, not a copy of existing school work. If these training schools or training classes were to utilize actual farmers' farms for a part of their work, the results, of course, would be much better. A vacation in the country is not farm work. Living in a country home is not farm work. One must actually do the work seriously and as good farmers do it. There should be some way of linking up many of the best farms with the training-school idea, the educational features to be under the direction of the recognized educational authorities of the State.

Society should take such action as will prepare the children to go to school.



A CHAT WITH RURAL TEACHERS

ALICE G. MCCLOSKEY

IN the majority of cases we find that teachers prefer to be in cities, but fortunately there are those who need to be in the open country where green things grow and where sky and wood and song of bird deepen and enrich the day; and where, for part of the year, there is all the magic of winter and its rugged gifts — the sparkling, snow-covered fields, the silent " snow-choked wood," the new mystery of starlight and moonlight, and the deep, wild winds.

There are in New York State some excellent rural schools, but many of them have been greatly neglected in the past. A survey of the buildings, the grounds, and the equipment of the educational centers of rural districts would, in a large number of cases, reveal conditions that indicate serious lack of interest. From these schools should come some of the strongest national leaders, since boys and girls in the country have rare opportunities for development, not the least of which are their contact with nature, their habits of industry, their experience in taking responsibility. These advantages should be supplemented by good instruction in dignified surroundings.

A point of view on rural schools that will interest many of our teachers is given in the following quotation from an article by Booker T. Washington, published in The Outlook:

" There are few sights more pathetic in purely rural districts than the ordinary country schoolhouse. Usually it is a little, lonesome building, stiff and unattractive in architecture, standing out in some old field, having not a single thing, either in its location, its outward appearance, or the work that goes on inside it, that indicates any connection whatever with the daily life of the people by whom it is surrounded. The very style and appearance of such a school building suggests a separation between school life and actual life that ought not to exist.

" There is no earthly reason why a country schoolhouse, in location, appearance, or any other respect, should be very different, inside or out, from the average farmer's cottage; in fact, there is no reason why a country school should not have both the appearance and the character of a model country home. My notion of a country school is a vine-covered cottage in the middle of a garden, with fruit and flowers and vegetables growing all about it. It should have a stable attached, with horses, cows, chickens;

a good well, plenty of hay and fodder, and a little repair shop connected with the barn, where boys might learn something of the trades that are necessary for a farmer to learn. Inside the school there should be, in addition to the assembly room, a kitchen, dining-room, and bedroom, where the children might learn to cook their own dinners, wash dishes, set the table, make the beds, and take care of the home. In such a school as I have in mind, also, the teaching of the book should connect it directly with the interests and problems of the locality. If the school is in a community in which dairying is prominent, there should be a vital connection between dairying and what is done in the schoolroom; if in a crop-raising, coal-mining, cotton-raising, manufacturing, or potato-

The rural school building on the Cornell University campus

producing community, the same kind of connection should be brought about between the schoolroom and the community."

At the beginning of the school year it is always well for a teacher to have in mind some specific improvements to be made before its close, and to keep a record of each when it is made. This will give opportunity at the end of the year for a survey of the work accomplished. Such a record will be of value in succeeding years. Perhaps the following suggestions, many of which have come from rural teachers, will be helpful in planning future work:

In every rural district there should be at least two **meetings of parents** each year, at which times the teacher may present her plans for the progress of the school and ask for the cooperation that will be needed in order to work them out. Perhaps the most important subject for discussion is the improvement of school buildings and grounds. If at the first meeting a few simple, essential suggestions are given, there will be less difficulty later in getting additional help from the district.

The first effort for the improvement of the interior of the **school building** should be to make it comfortable and clean. Simple white curtains at the windows, made by the girls, will add much to the home-like appearance. One good picture will be better than many that are small and unattractive. There should be at least one bookcase. One of the parents may be willing to make many of the repairs. A few of the mothers will doubtless be willing to help the girls to make the school-room neat and attractive.

The **school grounds** should be discussed. Doubtless two or more of the men will be willing to help plant simple shrubbery about the building,

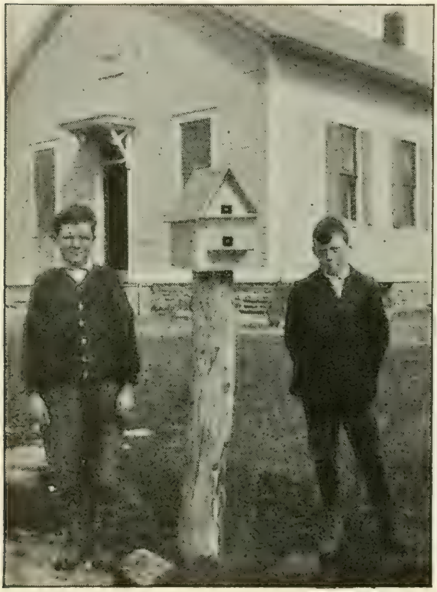
A rural school building

giving the older boys the educational opportunity of helping in this work. Fences should be repaired, definite walks made, and the entrance to the school should be as clean and as attractive as soap and water and fresh paint can make it.

A most important subject to present at a meeting of parents is the necessity for the children to have a good **physical background** for their life work. The health of boys and girls of school age should receive constant attention. If children are breathing through their mouths instead of through their noses, the cause should be investigated. Care of the teeth is most important. Many persons have been handicapped through life because their teeth were not taken care of in childhood. Fresh air in the sleeping-room should be discussed.

Teachers and parents, with full realization that **character** is more important than intellectual development, can work together to establish higher ideals among the young persons in the community. A child should be taught to respect his body; to stand on two feet; to be able to look with honesty into the face of any one to whom he is speaking; to play fair; to finish a piece of work in the best way possible; to be reverent in spirit.

The teacher may think it wise to have parents understand that she intends to cooperate with them in encouraging the children to form **habits of neatness.** A neat appearance is far more essential to success than is often realized. A little encouragement in the daily life, by means, perhaps, of commendation of children who are neat, will do much in this work.



An interest in birds is often awakened by making a bird house

It will be well also for the teacher to express her desire to help in teaching **good manners.** Loud voices, boorish ways, lack of consideration of older persons, and rough, boisterous habits of intercourse will often defeat young persons in many opportunities for growth and for pleasure that might otherwise be theirs. Children should be taught the reasons why definite social forms are observed. If this work is done with seriousness and with sufficient frequency, the children will soon realize its importance.

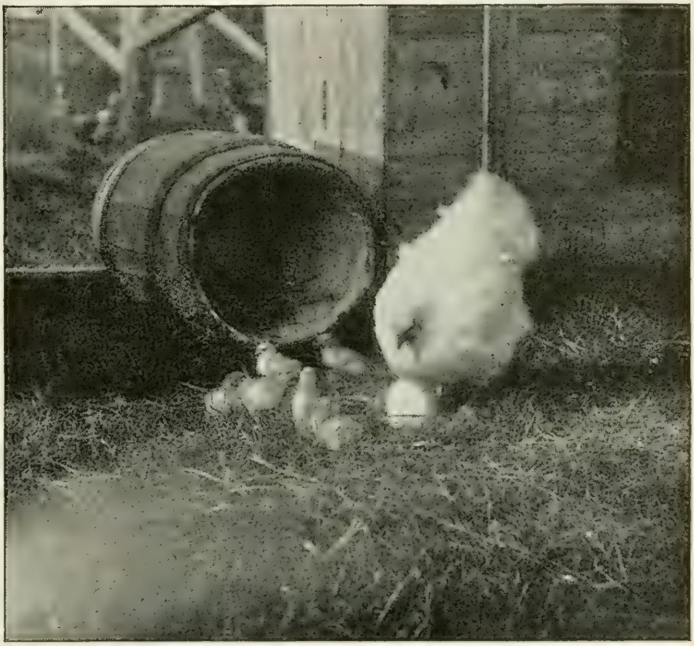
If the plans of the teacher include instruction in **nature-study and agriculture,** parents should understand the place that these subjects now have in the educational world. Many parents will say that they know more of agriculture than does the school teacher. This is doubtless true, but all lines of endeavor are dignified when made a part of the educational system; and when boys and girls work out with the teacher some problem in farm practice, the lesson may be connected with other school subjects, such as geography, language, arithmetic, and the like. Some parents object to nature-study because they have not fully realized that all boys and girls on the farm need for their best success a natural-history background. Many farmers possess this without knowing how it

was obtained. Since natural-history subjects have educational value, they may well be presented with other school work.

In the teaching of nature-study and elementary agriculture, it may be helpful to have in mind the following:

During the first six grades in school, out-of-door study should develop the spirit of the **naturalist** — a general interest in the out-of-doors. If properly taught, at the end of this period the child interested in natural forces and objects will have acquired a spirit of patient inquiry and accuracy in observation. He will begin to realize the kinship of out-of-door objects and the possibilities of interest and resource in them.

Teachers in country schools will find, however, that many of the boys and girls are not interested in nature-study from the viewpoint of the naturalist. The pupils should not be forced into this interest, but should be allowed to turn their minds to the more **practical side of the subject.** We have found very young children much interested in the commercial side of poultry-raising, growing potatoes, and the like. Let us encourage these boys and girls, and, if the teacher will help, they will get the point of view of the naturalist. A field of timothy is as beautiful as a field of violets. Who has not felt his spirit quicken at the sight of a field of oats in the sunlight or in the early evening? Who has failed to see the beauty of pumpkins in the cornfield in the "blue October weather"? What form of animal life is more attractive than young chicks or ducklings?



Many boys and girls are interested in poultry-raising

The work for the seventh and eighth grades, as outlined in the elementary

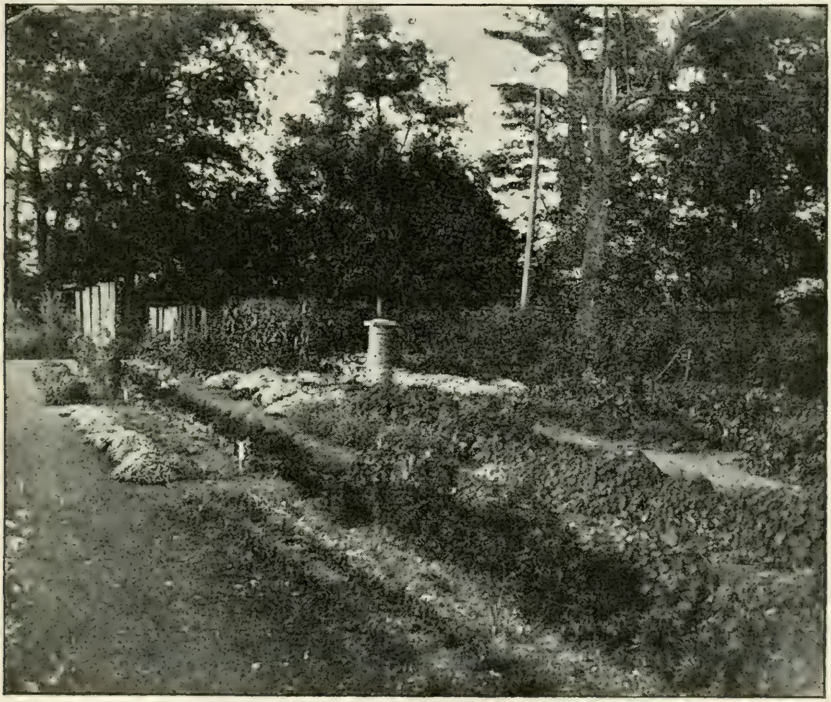
syllabus, has relation to **agriculture** and may be intensified according to the amount of time given to it and the interest of the teachers and pupils. Each lesson should lay the foundation for fundamental agricultural knowledge which will be introductory to high-school and college work in these subjects. We would advise teachers of the seventh and eighth grades to follow the work outlined by the syllabus for these grades, choosing for the most serious study, however, the subject that is of greatest interest in the community; as fruit-growing, raising of farm crops, dairying, or the like.

If **fruit-growing** is the special interest in the community, begin in autumn with discussions of the marketing of apples or other fruit. Have the pupils collect specimens of all varieties to be found in the neighborhood. Have these identified and labeled for a school exhibit. Discuss the most popular variety of fruit in your community and send the pupils on a quest to learn why it is the most popular. Ask a successful fruit-grower in the community to give a talk on the subject. During the school year plant a fruit tree. Let the tree planted by each class have significance and stand for a permanent piece of work. Have the children realize, even in the most elementary way, the interrelation and interdependence of outdoor things. For example, the study of soils in these grades will be most interesting and will have added value if made in the interest of a tree to be planted. Discuss the advantage of having a home fruit-garden. Boys and girls will take an interest in such a garden.

If **dairying** is the chief interest in the community, choose the subject-matter as outlined in the syllabus, for which specific material can be found. In country places a visit should be made to a farm in order that the children may learn the types of cows and begin to think about pure breeds of cattle. A Babcock test machine might be placed in the schoolroom and milk from different farms tested by the pupils. When the test has been successfully made in the schoolroom it would be valuable to have the class make this test at a grange meeting or a farmers' institute. The matter of balanced rations may be studied, also other subjects of interest on a dairy farm.

To encourage the children in their general out-of-door observations many teachers have found it helpful to have in the schoolroom a **nature-study corner.** There should be a table on which specimens may be kept, and above this a shelf containing reference books. The children may be taught to bring to the schoolroom specimens of plants to be left on this table until the teacher has time to identify them. If the teacher is unable to identify any plant, we shall be glad to have it sent to the University for identification. A good-sized specimen should be sent, showing roots, leaves, and flowers or fruit, if possible.

A **terrarium,** which is an inclosed piece of earth on which things may live and grow, has been found very interesting in some of the schoolrooms in New York State. Many kinds of animal life have been housed in terraria. The writer has seen salamanders, toads, snakes, butterflies, caterpillars, beetles, rabbits, hens, guinea pigs, and kittens in terraria in different schools. Children have been allowed to watch the animal life during leisure hours. (See page 1117.)



School garden on campus. The sun dial was constructed by the students in the school-garden course

Aquaria have not been very successful in most schools, but any teacher can use to advantage battery jars, or even Mason fruit-cans, in which aquatic forms of life may be kept for a limited time.

There should be opportunity for **gardening,** on however small a scale. The gardening connected with the rural school might well have relation to the planting of the grounds with some of the native vines and shrubs that can be found along the waysides and in the woods. There should be some experimental work that will have relation to farm interests. Corn, potatoes, a plat of alfalfa, or the like, will lead to observation of the home crops.

For the cultivation of a large piece of ground for children's gardens it is well to buy the seeds in bulk. Some of the older children will enjoy putting them in packets and marking them. The teacher, with some of the children, might estimate the number of lineal feet to be planted with each kind of seed. If the teacher does not know the quantity needed for this estimate the seedman will tell her. In some schools small penny packets will be found satisfactory. These can be bought of James Vick's Sons, Rochester. *All orders must be sent through the teacher, as given below.*

James Vick's Sons

189 Main Street, East — 18–20 Stone Street

Rochester, New York

Post office.. State..

School No.. Grade..

Teacher..

Please fill our order for the following:

Flower seeds

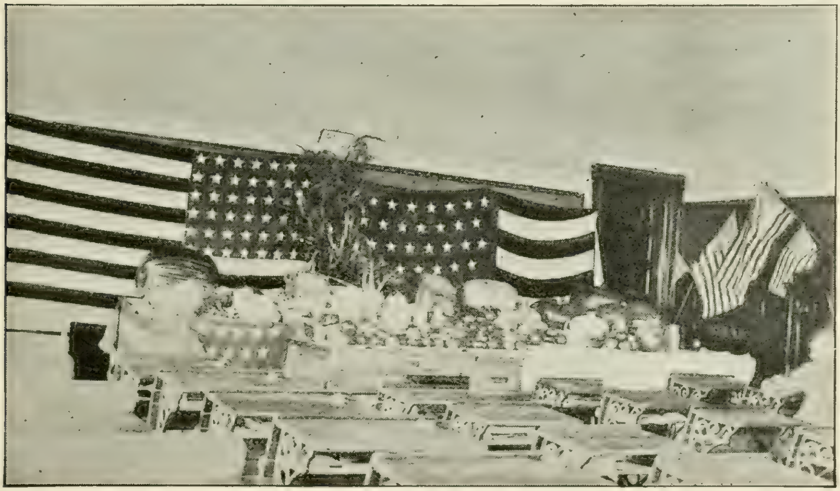
....	Aster	....	Nasturtium { Dwarf or Climbing
....	Alyssum	....	Petunia
....	Bachelor's-button	....	Phlox
....	Calliopsis	....	Poppy
....	Candytuft	....	Scabiosa
....	Dianthus	....	Sweet pea
....	Marigold	....	Zinnia
....	Mignonette		
....	Morning-glory		

Vegetable seeds

....	Beans	....	Onions
....	Beets	....	Radishes
....	Carrots	....	Spinach
....	Lettuce	....	Sweet corn

Two cents postage should be added for every twelve packets of flower seed, and three cents for every twelve packets of vegetable seed. Large orders will go cheaper by express, charges to be paid by the purchaser. No order is accepted for less than one dozen packets.

One of the greatest needs in the country school to-day is that boys and girls should have an opportunity to become ready readers. Interest in **good books** will open up the world in far-reaching ways and will give a resource for the future that all boys and girls in the country should have. It is not necessary that there should be many books, but the rural library should be well chosen and should contain a few works of history, travel, poetry, and fiction. The books should be chosen according to the



A school exhibit of garden crops

age of the pupils. There should be a few good reference books in nature-study and agriculture, for boys and girls living in the country should have intelligent knowledge of country surroundings. (See page 1303.)

It will be well to have the pupils learn at least one good poem during the year. Memorizing verse often develops appreciation of it, and poetry should be a part of the education of every individual.

A most valuable way of arousing the interest of young persons in any new work is to have **exhibitions.** There is educational value in such endeavor, as the children nearly always make their very best effort in preparing the individual exhibits, and they have opportunity to compare their work with that of other pupils. The small school exhibits are doubtless as valuable as any, and the children should be encouraged to

prepare for them. An exhibit of fruit or corn or the eggs and feathers of poultry, or a general nature-study exhibit, will bring about a broader interest than will many formal lessons along agricultural lines. Often schools prepare exhibits for the county fair, and some for the state fair. Many send exhibits to the State College for **Farmers' Week.** This year we should like one nature-study exhibit, and also two ears of corn, from each rural school in New York State. (See page 1276.) This should be sent to Ithaca by January 31, addressed to the Department of Rural School Education, College of Agriculture, Ithaca, New York.

There should be at least one **field trip** each year, in which the children have an opportunity to share out-of-door experiences with the teacher. No matter how little knowledge of nature any of the group may have, the trip will be worth the while. In the springtime many specimens of plant life can be collected for future discussion at school. In winter a short trip into the snow-covered fields or woodland will give joys that will never be forgotton. Who does not remember the older persons who gave them out-of-door companionship? The following poem presents this idea in a very attractive manner:

GRAMP

JAMES BUCHNAM

"*What a man to fish and camp!*
What a man to hunt and tramp
Up and down the woods was Gramp!

"*How he led me high and low,*
Plunging through the brush and snow,
Boylike, how I loved to go!

"*O, the sweet days that we spent*
In the forest's pure content;
O, the long, still miles we went!

"*Keen-eyed Gramp, how well he knew*
Where the biggest berries grew,
Where the witchlike woodcock flew.

"*Learned was he in all the lore*
Of the woodwise men of yore,—
Subtle knowledge taught no more.

"*Ah! a happy boy was I,*
Loving God's free air and sky,
With dear Gramp to teach me why."

LETTERS FROM TEACHERS OF RURAL SCHOOLS

A field trip in winter

1. *Extracts from a letter written by Miss Mary Edwards, School District No. 2, Town of Scott, Cortland county:*

"My school began in March, 1912. It was in a small hamlet and I had about thirty-five pupils. They knew practically nothing of nature-study, as their observation had not been encouraged or trained.

"Our building was not in any condition to inspire a child to appreciate the beautiful. The curtains were old and torn, the paint on the inside walls was a dingy gray, the plaster was falling off, the blackboard space was limited, and the desks and seats were in need of varnish. There were many other unsightly things in and about the school.

"I organized a nature-study class, and our first work was to keep a weather chart. Each individual kept one in which he recorded temperature, winds, moisture, and the like. There was a great effort to obtain the earliest observation of the thermometer; it led to early rising and a keen observation of wind, clouds, stars, and sunsets. Many an evening I have been called out to see a beautiful sunset, a bright star, or pretty formation of clouds. We always discussed anything unusual. What pleasure we have derived enjoying those beauties!

"The class knew nothing about birds. We began an individual bird calendar. Each morning any member of the class had the privilege of reporting a bird seen and was encouraged to describe it. I received some very remarkable descriptions of color, size, and markings. The best report was placed on the wall calendar. We learned to recognize and describe each bird until now they can recognize over fifty birds.

"Next we kept flower calendars and studied the specimens. The older members made a large collection of pressed flowers and weeds. One

boy won $3.50 at the county fair for a mounted collection of weeds. It was surprising how interested the parents became. I would often refer some question to the parents by requiring the child to ask for information about the locality of some tree, weed, or other object, and would ask the opinion of the parents on many points.

"I was anxious to bring the home and school close together. We organized a real school society called 'The 3 M's;' our motto is, "Better minds, better muscles, and better morals." The object is to develop the three sides of the nature. A club song and yell were composed. We have buttons of gold, red, and blue. I gave the girls sewing lessons to make pennants. We have quarterly election of officers. This election awakens great interest, as it is considered an honor to become officers because they have supervision of the school garden and always assist in the management of the socials and entertainments. We gave one play which was arranged specially for 'The 3 M's,' to show the object of the club. We generally give our entertainments at the school building, but this was given at the church by request. The play was written to bring out the thought that the mission of 'The 3 M's' is to brighten up the dark spots in our town. They certainly gave their song and yell with a vim and true school spirit. They acted the three scenes without a mistake. The parents certainly felt proud of their school club.

"After observing school garden work under the direction of Mr. Hawkins at the normal school, I was very anxious to have one in my school. We have very large school grounds, therefore a garden would not deprive the children of their needed playground. Our school garden has been a decided success. We have both vegetables and flowers in one garden. Nearly every child here has a home garden besides. The money for all the seeds has to be earned by each individual, who reports how he or she earns it. We send flowers to the sick and vegetables to the fair and we also have an exhibit at school. What remains we feed to our school pets, our doves and rabbits. We have many bird houses on the grounds. We feed our school squirrels during the winter.

"I find the school garden no trouble during vacation, but rather a tie to hold the school and home closer. I make occasional visits to the garden during my vacation and never find it neglected. It gives the children a sense of responsibility and moulds character by demanding self-reliance. It gives the children practical training for the eye and the hand. Each child keeps a record of the development of the garden in a book called the 'Garden Book.' Each child writes for a seed catalogue and uses the colored pictures in relation with the lessons on each crop in one garden. For example: we have a detailed study on corn, and all notes, observations, drawings, and developments are placed in the garden book. The diagram map and complete record of all crops are made in the book. In this way we study practical agriculture. This brings school and home into closer relation by giving the child application in the home garden of what he has learned at school. I ask advice of the parents and always consult with them, making them feel that our school is trying to learn and gain information from all points. We receive the bulletins from Washington, Geneva, and Cornell. The children are delighted with their intercourse with the State College. The parents made a special effort to have the children go to hear one of the lecturers

from Cornell. On the same day we made a visit to the library museum to study the birds.

"I was surprised to learn that the parents had not been in the habit of visiting the school. We endeavored to develop community spirit. A community institute at the church was a great encouragement.

"I felt that if the parents could see the condition of the school and be made to realize its many wants, they would respond to my efforts to better the equipment. I talked to the parents about their apparent lack of interest in the school affairs because they did not come to see our actual daily work. I influenced the mothers to come in a body one afternoon. They were delighted with our regular school program. Among other songs we sang, 'Why don't parents visit the school?' I entreated them to come and see us oftener. When they went away I went to the door and called their attention to the mud hole around the building. I asked if they would not help me to induce the men to help my boys draw some gravel the next morning, as we were to have a conference of teachers and mothers that week. At half past seven the next morning my gravel was drawn and my school boys graded it.

"I had evening entertainments to get the parents together, and I talked school equipment. We had socials of various kinds at the schoolhouse. Those affairs were always successful, both socially and financially. We have invested the proceeds in an organ — which has been a source of unbounded pleasure — new window shades, paint for the schoolroom and halls, varnish for seats and desks, a large chair, and other articles. We have more blackboard room, new plaster, and three new maps.

"The schoolroom was somewhat congested during those socials, as people came from far and near to help on the good work. The friends and parents were deeply interested in our nature-work exhibit, honor rolls, drawings, and the like, which were on exhibition. Each parent was interested in his child's work.

"We have many happy times, Christmas trees, Hallowe'en parties, and the like, which are held at the school building. Our field excursions are among our most delightful times — those trips are so instructive. Each child is wide-awake to every sound and to every glimpse of a specimen, as our nature collection is the pride of their hearts.

"We began to collect our specimens for lessons and we placed them on a nature shelf, but our broad collection outgrew the nature shelf, so I suggested that we endeavor to get a Larkin soap order of $10 and get a case suitable for our insects, nests, fungi, stones, barks, leaves, and flowers. Four of 'The 3 M's' girls started out a very cold night, but their enthusiasm kept them warm, for they succeeded in getting sixteen orders. Every one was anxious to sign when they knew what it was for, as our nature museum is the pride of the community. Every one saves specimens for us. We study each and every specimen. We obtained a six-foot case with shelves, drawers, and compartments; we also purchased a stand for our dictionary and aquarium. Of course we have goldfish, tadpoles, snails, lizards, and frogs.

"Last year we took our nature exhibit to the fair and received the grand prize of $10, besides many other premiums. We invested our prize money in a nature-study library and forty volumes of the five-cent

classics.* Those little books are jewels; the children are wild over them; they are so short and instructive. I have to force the little folks out of doors to play. They want to read those classics. We have obtained a traveling library. It is a fine collection, as I received just the books that I desired. The district gives $5, which the State duplicates, each year for library books.

"We often have picnics to the woods, which are a great treat. Last year the parents gave me a great surprise by opening one of the large farmhouses where I was invited and found about two hundred friends to greet me. A fine supper was served and I was presented with a piece of silver.

"This year the hope is to have a union picnic of the town schools; this may pave the way for a union school, which our school is advocating. Our school sent three students to high school this term. One of our boys made all of his preliminaries at twelve years old. My boys and girls have a great desire to attend high school.

"We have recently organized a 'Junior Improvement League.' It has had fine results thus far. The parents are interested, as usual, in all that we undertake. I have just ordered two hundred packages of seeds for home and school. We have a contest for the largest and best flowers. We are to enter a corn-growing contest for a five-dollar prize.

"I secure the cooperation of the parents in everything I undertake. My patrons cannot do enough for us when we ask their aid in socials and entertainments.

"There are two sides of teaching — the schoolroom side and the community side. We cannot teach school successfully if we are not masters of the first, but we cannot make the best success if we are indifferent to the second. We must meet and mingle with the people and bring them to our schoolroom, showing them indirectly our work and needs.

"We should teach right living and high thinking, and the power of education in the development and progress of our Empire State should be ever in mind. We must create a public sentiment for good schools and education in the community, which will bear fruit for generations."

2. *From a letter written by Mrs. M. Alice Taft, East Cutchogue, Suffolk county:*

Editor's Note.— We are interested in the effort that many rural teachers are making to give boys and girls an opportunity to know the viewpoint of successful men and women in their community. The following letter presents some valuable information along this line:

"In response to your request for information concerning the innovation made in our Friday afternoon program, I respectfully submit the following:

"The thought was first suggested by a casual remark of our highly esteemed, progressive, helpful District Superintendent, Mr. Charles H. Howell, who has served continuously as School Commissioner and District Superintendent since January 1, 1888, and has, therefore, given the State longer service in that capacity than any other man.

"It was augmented by the great interest and hearty cooperation of our trustees, and further strengthened by an earnest desire to bring the

*Published by the H. A. Owen Publishing Company, Dansville, New York.

people into a closer touch with the school, and, at the same time, to put a pleasant, instructive diversion into the school life of the pupils.

"To aid in the execution of this plan, we have asked the cooperation of those who can do something well, know how to talk about it, and are so in sympathy with childhood that they can express themselves in a manner suited to the understanding of boys and girls. In every instance those who have come to us have not only complied willingly with our request, but seem to feel honored by being asked.

"The ball was started rolling by the appeal of Mr. Tuttle for the celebration of Corn Day. We planned a simple program that in no way interfered with our school work. The primary pupils recited some little poems — most of them previously learned — while ten of my pupils prepared compositions, five on 'Corn' and five on 'The Hen.' To stimulate to best effort, I offered a prize to the one having the best paper as decided by the united vote of visitors present and non-contestants in the higher grades. The work was given them on Monday as an English lesson, on Tuesday for spelling, on Wednesday for writing, on Thursday for reading.

"I asked one trustee to talk to the school on 'Corn,' and another, a corn expert, to act as judge of our exhibit. The former gave a most interesting exercise, talking and asking questions, while the latter took infinite pains in making his decision as to the best ear of corn.

"I want to emphasize the fact that to our trustees belongs the greater share of the credit of the success of these attempts. With untiring zeal they have always stood ready to ask our speakers (or instructors) or to act in that role themselves. Regular school work lasts until 2:30 o'clock, and then our visitor is allowed to occupy as much or as little time as he or she desires.

"Some of the lessons given by the trustees have been on splicing rope, the eye splice, knots and hitches, seed-planting, pruning, and grafting.

"From others I shall mention a most excellent talk on 'Making the Most of Life,' by the Catholic priest of an adjoining district. Our Methodist pastor of this village, who is intensely interested in boys and girls and is a fine singer, gave us a lecture on 'Music' and then sang with them, greatly to their delight.

"We are greatly indebted to a veteran of the Civil War, who gave three years of faithful service and was in sixteen battles, for 'A Personal Knowledge of the Great Conflict,' which will be most helpful in clinching facts about Gettysburg, the Battle of the Wilderness, Lee's surrender, and other events. A trained nurse pleasantly told the children of 'First Aid to the Injured.' We have a lot more of good things in contemplation, but I have enumerated a sufficient number to give an idea of what we have been doing.

"I am convinced that no teacher, no matter how capable and intelligent he be, could have impressed these boys and girls so deeply as have these outsiders, and I am quite sure that among the recollections of school life of 1912–1913 they will hold these Friday afternoon innovations most dear."

THE DISTRIBUTION OF THE CORNELL RURAL SCHOOL LEAFLET

Edward M. Tuttle

AS the demand for the Cornell Rural School Leaflet constantly increases and many persons are newly added to the lists each year, it may be well to describe briefly the methods employed in distributing the publication.

The first number of the leaflet for each school year is published in September and is known as the September, or subject-matter, leaflet. It reaches all teachers of elementary grades without individual request on their part. The names of all teachers under rural supervision are obtained at the earliest possible date from the district superintendent, and a copy of the September leaflet is sent directly to each teacher. Grade teachers in cities and incorporated villages receive the leaflet from their superintendent of schools, to whom copies are sent in bulk for distribution.

Every teacher in New York State below the high school is entitled to a copy of the September leaflet. In the case of teachers under city or village supervision, this is the only leaflet available to them during the year. In the case of teachers under rural supervision, additional copies of the Cornell Rural School Leaflet are available. They may be obtained as follows:

Accompanying the September teachers' leaflet will be found a blank form for the names of pupils. This blank should be filled out immediately and returned to Miss Alice G. McCloskey, College of Agriculture, Ithaca, New York. The pupils' names will then be placed on file and each teacher will be sent a sufficient number of copies of the leaflets for boys and girls to supply the school. We hope to send three leaflets for children—one in November, one in January, and one in March. These are distributed to the pupils by the teacher.

To summarize: In order to perfect our method of distribution, teachers in elementary schools should remember the following:

1. A copy of the September number of the Cornell Rural School Leaflet for teachers will be received through the mail early in the school year.

2. A blank accompanies the teachers' leaflet, which is to be used only by teachers of elementary grades under the supervision of district superintendents. (See page 1307.)

3. The blank should be carefully filled out with the name and address, district number, township, county, name of district superintendent, and names of pupils.

4. The blank should be returned at once to Miss Alice G. McCloskey, College of Agriculture, Ithaca, New York.

5. Three times during the year a package of children's leaflets will be received through the mails.

6. These leaflets should be distributed to the pupils whose names were on the list sent.

7. Any changes of teacher or pupils in the school should be reported in detail at once, in order that the records at the College of Agriculture may be complete and accurate, thus enabling prompt, correct, and effective distribution of the Cornell Rural School Leaflet.

DISTRIBUTION IN 1912–1913

It may be of interest to teachers and others to examine the following report of the distribution of the Cornell Rural School Leaflet last year:

Copies of the leaflets sent out:

To cities	16,656
To villages	1,380
To training classes	6,376
To teachers in rural schools	39,255
To rural children	415,392
Total	479,059

Range of distribution:

1. All rural teachers received the teachers' leaflet. Of these, 8,191 returned lists of pupils' names.

2. All but ten of the fifty cities and all but six of the forty-one villages of the State received leaflets.

3. All training schools and training classes were supplied.

4. In rural districts, 137,285 children received all three of the children's leaflets, and 6,218 more received the March leaflet.

AGRICULTURAL CONTESTS

THE EDITORS

One of the most important movements in rural education, and one that will continue to grow in importance from year to year, is the organization of agricultural contests for boys and girls. Teachers of rural schools are in a position to be of great service in this work and it seems advisable to give at this time a brief outline of its present status.

The State College of Agriculture recognizes that agricultural contests for boys and girls may produce results of great value in intellectual and moral development, or they may indirectly harm the community. The controlling factor is the point of view of the leader. Contests that educate and train children are strong character-builders and they will doubtless be conducted most wisely if the work is done under the direction of the State Education Department. Throughout New York State many agricultural contests for boys and girls are being conducted under the direction of district superintendents of schools, who are responsible for the educational work and who know local conditions.

Last year we prepared a special leaflet on agricultural contests and placed it at the disposal of the district superintendents, who are to order copies for use as they think wise. We hope that eventually a copy of this leaflet will be placed in every school library.

Teachers can be of assistance to district superintendents by creating local sentiment in favor of agricultural contests; by encouraging boys and girls to enter them; by cooperating in following the contests during the summer; and by helping with the arrangement and care of the exhibit and the preparation of the program at the exhibition in the fall. Every teacher in the community should work with the leader to make the contests a success, to see that no child who enters fails to carry his work through to a definite result, and to give encouragement and help to contestants in hard places.

We call these matters to the attention of teachers because we believe that agricultural contests properly conducted have real educational value. Teachers are in a position to be of great service in the enterprise and we hope that they will take active interest in the movement. A personal touch with boys and girls or with parents and neighbors increases the teacher's opportunity to be a vital factor for good in the community. Agricultural contests offer one more means of establishing a cooperative spirit in the entire neighborhood.

CHILDREN'S LETTERS

Edward M. Tuttle

Girls and boys like to write letters. They like to know that they are writing to a real person, and that their letters will be sent through the regular mails to some one who is interested to receive and read what they have written.

It is our practice to publish, in each number of the Cornell Rural School Leaflet for boys and girls, a personal message in the form of a letter that calls for a response. The purpose of the letter-writing is to give the children an objective interest and an outlet for their thoughts, and to en-

Young letter-writers

courage them to consult specialists in matters relating to country life. This will be most successfully accomplished when the children come to feel that their letters are not to be critically read, but rather that the reader will have sympathy and understanding.

We hope that teachers will encourage children to write letters, either as a collective school exercise or individually as the children desire to express themselves. All letters should be addressed to Edward M. Tuttle, College of Agriculture, Ithaca, New York. To any child in rural districts who writes three letters during the year, we send a small gift picture. In order to receive credit toward the picture the letter must contain clear information as to the district number and the name of the township and county in which the school is located.

The letters need not be of any particular length or on any special subject. The following letters are taken from among those received during

the past year. The first is short, simple, direct, yet contains definite ideas and is therefore worth while. The second is from an older child and shows more development in thought and expression. All letters are acceptable that represent earnest effort and real interest.

District 5; Town of Allen; Allegany county
Angelica, N. Y., May 9, 1913

Dear Mr. Tuttle:

I take pleasure in writing to you again. I received the leaflet a short time ago. I am very glad to get them and thank you for them.

I enjoy reading and studying them. Arbor day we went to the woods and picked some flowers and dug a little maple tree and we planted it out in the northeast corner of the school ground and cleaned the yard. I am going to make a garden at home. I like to work in the garden. I help papa do chores and farm. I have fifteen pullets. I sell the eggs and put the money in the bank to go to school with when I get through with the grades. This is my third letter. Now I am expecting the picture.

Yours truly,
DANIEL DAMON

District 14; Town of Springfield; Otsego county
Van Hornesville, April 10, 1913

Dear Mr. Tuttle:

Our district superintendent, Mr. Cossaart, visited our school last week. He told us that he had met you.

Our schoolhouse is the only stone schoolhouse in the town. It is very pleasant. It stands upon a small hill and faces about a quarter of a mile of a main traveled road extending from Fort Plain to Cooperstown.

The scenery around here is very beautiful. There is a small lake near here about a mile long, called "Lake Summit." Not far from here is the head of the Susquehanna River. It is called the "Cold Spring."

We are all interested in the locust tree as that is the tree we are to study this year. We are going to plant one Arbor Day. We are also going to take up a collection and buy some ivy vines and let them run over the schoolhouse. We are planning to have a flower garden. A few of our school boys are going into the corn contest, and some girls and myself are going into the bread contest. Ten dollars is offered for the most corn raised on a plot of ground twenty-five by twenty-five feet, and ten dollars is offered for the best loaf of bread. We have tested some corn.

Our teacher's name is Miss Elizabeth L. Hill. This is the first year of school she has taught. She is very good to us and tries to get us interested in the study of nature.

Mr. Cossaart said that you spoke of walking over the country of New York State and visiting the schools. I hope you will visit our school. I read in the leaflet about your visit at a school in the country and wish our school was near so that you might visit us.

Last fall the boys of our school cut the wood and the girls piled it. We earned two dollars, and the year before we earned one dollar by piling it. We intend to buy a large picture for the school.

I would enjoy a letter from you, but realize that you are busy and cannot answer all letters that are written to you.

Sincerely yours,
EDITH M. BORST

CORN DAY

(Friday, December 5, 1913)

Edward M. Tuttle

Corn Day should stand for definite things in the school and in the community. It should stand for a greater interest in the corn crop. It should stand for more intimate relations between school and home.

We hope that teachers will see in this annual celebration the possibilities of something more than a school exercise. The subject of Corn Day should be presented to the children early in the year so that they may have time to think about it and make plans. One or two lessons on the essential features of a desirable ear of corn for seed should be given during the fall. Each child should be stimulated to make effort to obtain the most nearly perfect ear of corn grown on his home farm, and to have the ear properly labeled in readiness for Corn Day.

The gathering of corn for the school exhibit affords excellent opportunity for children to use the knowledge that they have previously gained regarding points to be considered in the selection of seed corn. Endeavor should be made to have boys and girls realize the practical importance of selection, and the great improvement, both in yield and in uniformity, that will result from carefully choosing for seed those ears that approach most nearly the ideal type.

A simple program of songs, recitations, and readings may be prepared. The children may send out invitations to their guests. It is desirable to decorate the schoolroom with cornstalks, pumpkins, and the like. A prominent farmer may be asked to judge the corn and award simple prizes to winners. A most valuable exercise might consist in reports on the growing of corn in the district, which have been previously worked out by the children. We would suggest that one child find out the number of acres grown in the district; another, yields obtained from different fields; another, methods of planting, cultivating, and harvesting employed; another, methods of selection and storage of seed as practiced by growers; another, uses made of the corn crop. These topics may suggest others. The point involved is that Corn Day will be of value in proportion as it is closely related to the community, and in proportion as interest is stimulated to determine seriously how important the corn crop is to farmers of the locality and whether or not there may be ways

of increasing yield or improving quality. It might be well to suggest to parents that they have the boys and girls help them in selecting seed corn for another year.

We shall publish in the November leaflet for children further information regarding Corn Day, selection of ears of corn, preparation of the exhibit, and the forwarding of prize ears to the College of Agriculture. We shall ask to have the two best ears of corn from each school sent to represent the school at our Farmers' Week exhibit — the best ear of

A rural school exhibit. Farmers' Week at the New York State College

flint and the best ear of dent corn. We shall also give directions as to labeling the ears. A list of four hundred and forty schools that took part in the exhibit at the College last year will be included.

For the use of the teacher prior to receiving the November leaflet, we include at this time several Corn Day programs as submitted by the schools celebrating Corn Day last year; also a statement by Professor Gilbert of the points to be considered in selecting corn for seed, as follows:

1. *Shape of ears.*— A perfect ear of corn should be full and strong in the middle part, indicating a strong constitution. It should retain this size to near the tip and butt, thus forming as nearly as possible a cylindrical ear.

2. *Butts of ears.*— The rows of kernels should extend well down over the butts of the ears, thus giving an ear of better appearance and con-

taining a higher yield of grain. The shank, or part of the stalk that is attached to the ear, should be not too large and coarse. Swelled, open or badly compressed butts, as well as those having kernels of irregular size are objectionable.

3. *Tips of ears.*— The tips of the ears should be well filled out, indicating a type of corn that will easily mature. The rows of kernels should extend in a regular line to the extreme tip of the ear.

4. *Shape of kernels.*— The shape of the kernels is very important. They should broaden gradually from tip to crown — with edges straight, so that they will touch the full length — and should be wedge-shaped without coming to a point. Kernels of this shape will fit close together and thus insure the highest possible yield of grain that can grow on the cob. If the kernels have this wedge shape, no wide spaces will be found between the rows. Such spaces are always objectionable.

5. *Proportion between corn and cob.*— There should be a large proportion of grain as compared with the amount of cob. This will be the case with ears having deep kernels. A large ear does not necessarily indicate a heavy yield of grain, and it is objectionable in that the cob, being large, contains a considerable amount of moisture which, drying out slowly, injures the grain for seed purposes.

6. *Color of grain and cob.*— Good corn should be free from admixture. White corn should have white cobs and yellow corn should have red cobs.

7. *Trueness to type or race characteristics.*— The ears selected for an exhibit or for breeding purposes should be uniform in size, shape, color, indentation, and size of kernel. They should also be true to the name of the variety.

PROGRAMS FOR CORN DAY

I

Study of corn from leaflets
Corn. Talk by teacher
Selections read by pupils:
- Germination
- Kinds of corn
- Cultivation
- Selecting seed
- Grading corn
- Corn as a food
- How Indians planted corn
- How Indians made corn cake
- Ancient Egyptian corn-planting
- How to judge corn
- Judging of corn exhibits

II

A corn story. Carpenter's Geographical Reader

Uses of corn. To be written by the children

Points that constitute a good ear of corn. Importance of careful selection of seed corn. Both to be written by the children

A corn game. The children make as many words as they can, using the letters in CORN DAY

The judging of the corn

Explanation of testing corn by the teacher

The drawing of an ear of corn by each child

III

Singing.....................America.....................School
Reading....................The corn plant
Recitation..................Five kernels of corn
Reading....................Why we raise corn
Pop corn song and recitation.............................School
A letter to farmer boys on "Education in Corn," by Mr. A. J. Bill
Recitation..................The corn
Reading....................Some facts about corn
Singing.....................Husking song................School
Reading....................How to grow corn
Reading....................Corn pests
Recitation..................Blessings on the cornfield
Discussion..................Testing and germination of seed corn
Discussion..................Silos and ensilage
Judging corn exhibit
Plenty of pop corn to eat

A MESSAGE TO NEW YORK STATE TEACHERS

A. R. BRUBACHER

(President of the New York State Teachers' Association)

The State Teachers' Association has set itself the high task of promoting the professional and physical welfare of the more than 40,000 teachers of New York State. To this end it invites the support and cooperation of all persons interested in education, both laymen and teachers.

The teacher's physical welfare depends upon hours of daily work, rest periods, length and frequency of vacations, sabbatical years for rest or study, evenness in methods of supervision, correct lighting, heating and ventilating of schoolrooms, and such other matters of sanitation as dustless crayon, effective cleaning of floor and black-boards, individual towels, drinking cups, and medical inspection that will guarantee against contagion and infection in her room. These are matters that are receiving increasingly respectful attention in all parts of our country and in Europe. There is even some uniformity of practice in many cases. Vacations are fairly uniform in length and season; the school day of five hours is general; medical inspection promises to become universal in the near future; and schoolroom sanitation now guarantees uniformly high standards in new school construction. We may, therefore, address ourselves to the task with high hopes so far as the physical welfare of teachers is concerned.

We cannot entertain equally high hopes regarding the professional welfare of the teaching body. Here we have to combat great inertia and some apparently inherent obstacles to progress.

The teacher has an average professional career of less than five years. This makes the profession extremely unstable. Change of professional standards can be quickly accomplished, but its permanence cannot be readily guaranteed. The short professional career makes it very difficult to establish any ethical standards because those members of our profession who remain two or three years only, never acquire any professional pride. The stability of character, breadth of view, mental maturity, and intellectual sobriety of the veteran practitioner give dignity and worth to any profession. Among teachers a very small percentage remain long enough to become veterans; a large majority leave below thirty-five.

We are therefore justified in making even more strenuous efforts to establish a code of professional ethics that the young teacher may early come into the heritage of right standards and correct and clean practice. The State Teachers' Association is now at work through committees to work out our professional salvation along the following lines:

1. A code of professional ethics is being formulated and if adopted by the association next November at the Syracuse meeting, the teacher as a professional or occupational entity will necessarily rise to a higher standard.

2. A revitalized State organization promises to give every teacher in the State a professional consciousness — a feeling of pride in the teacher as a class.

3. A permanent secretary will give continuity of policy to the State Association and will make possible a bureau of professional information on which both teacher and school official may make demands.

4. A truly representative State Association, enrolling not eight per cent of the entire body of teachers of the State, but at least eighty per cent, if not one hundred per cent — a truly representative State Association will be able to conserve the individual teacher's rights as against the unreasonable rural trustee or the village and ward politician. This will be reasonable tenure of office and will likewise protect the city against the evil of keeping the inefficient teacher in office.

5. High professional and ethical standards will inevitably give the teacher social and professional dignity and will place the school where it rightfully belongs, side by side with the church and the state.

It remains for the teachers of the State of New York to support their State Association loyally and with enthusiasm. Let every school teacher unite in some local organization of teachers, district, village, or city. You have already been offered an opportunity for such association. If there is one reader of these lines who has not been invited to join some such local unit of the State Association, he or she should write freely to the President of the New York State Teachers' Association, Schenectady, New York.

Editors' note:

Mr. Brubacher's efforts in behalf of the teachers of New York State are so fundamental and essential, if the standard of the teaching profession is to be raised, that we asked him to send a message to teachers in this publication. Inertia has defeated many a strong movement. We hope that the seriousness of the need for developing the teaching profession will lead to definite effort on the part of each individual.

There is in our office a report of the meeting of the New York State Teachers' Association held at Buffalo last November. This work contains the viewpoint of some of our strongest educators. Every teacher should have this work, and a membership fee of fifty cents has placed it in the hands of all who have joined the New York State Teachers' Association. This report is of special value to the teachers who are not able to attend the annual meetings of the association.

HELPS IN THE STUDY OF PLANTS

E. L. Palmer

When one wishes to learn the name of any flower that he may happen to pick up, he usually does one of two things: either he asks some person to name it for him, or he attempts to look it up for himself in a book. There are two kinds of books on plants, the popular and the scientific. The former is usually the more convenient for general work, but as a rule the scientific book is the more accurate. The difficulty with scientific books is that to most persons they are unintelligible because of the terms used in describing the parts of the plant. It is hoped that this article will explain clearly the meaning of some of the more common terms used.

In the first place, the parts of a flower should be learned. The parts of flowers are arranged in groups. There are usually four of these. In the trillium, for example, we see on the outside a set of three green, leaf-like structures. Each of these is known as a *sepal*, and the three together make up what is known as the *calyx*. In most flowers the calyx is green. Within the calyx we find a second set of structures which are either white or conspicuously colored. This set of structures is known as the *corolla* and the separate parts are the *petals*. The corolla and the calyx constitute what is known as the *floral envelope*, which is usually made up of structures that are more or less leaf-like. The floral envelope is not really essential in the production of seeds.

The essential parts are the two inner series. The outer of these is usually made up of structures that look like stalks with a thickened part on the end. These structures are known as the *stamens*; the stalk being known as the *filament* and the thickened part on the end as the *anther*. When the anther is ripe it breaks and gives off a powdery substance known as *pollen*.

The inner series of structures is made up of *carpels*, these being often united to form the *pistil*. The pistil bears the seeds. The pistil may be composed of either one or more carpels; in either case it is subdivided into three parts. The lowest part, which is usually the largest part, is called the *ovary*. This contains the seed or seeds. Above the ovary the pistil is elongated into a structure known as the *style*, at the top of which is the *stigma*. The number of branches, or lobes, in the stigma usually indicates the number of carpels in the pistil.

The stem that bears a flower is known as the *pedicel*; and the end of the pedicel, or the part that the parts of the flower actually touch, is called the *receptacle*, or *torus*.

Now that the parts have been named, let us consider some of the variations and combinations that occur. In the first place, we

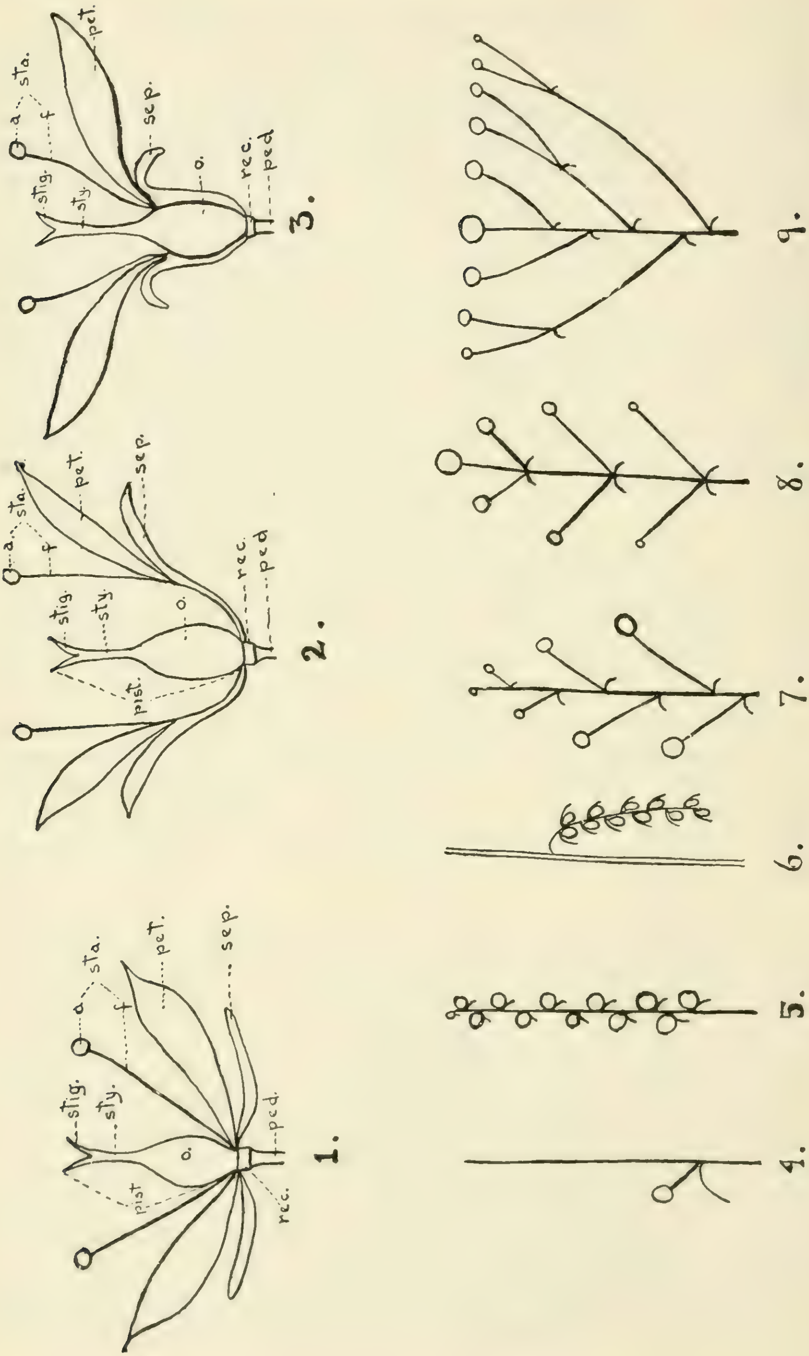

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FIG. 1.— *Diagram of an hypogynous flower, of which buttercup, trillium, and chickweed are examples*
FIG. 2.— *Diagram of a perigynous flower, found in plum and apple*
FIG. 3.— *Diagram of an epigynous flower, examples of which are dogwood, elderberry, and sunflower*
FIGS. 1 — 3: *Stig.– stigma; sty.– style; o.– ovary; pist.– pistil; a.– anther; f.– filament; sta.– stamen; pet.– petal; sep.– sepal; rec.– receptacle; ped.– pedicel*
FIG. 4.— *Solitary inflorescence, as in abutilon, moneywort, and whorled loosestrife*
FIG. 5.— *Spike form of inflorescence, as in blue vervain, heal-all, and plantain*
FIG. 6.— *Catkin form of inflorescence, as in willow, oak, poplar, birch, and butternut*
FIG. 7.— *Raceme, as in cork elm, barberry, and wistaria*
FIG. 8.— *Cyme, or indeterminate inflorescence, such as is found in apple or geranium*
FIG. 9.— *Corymb: the form of inflorescence commonly seen in elderberry*

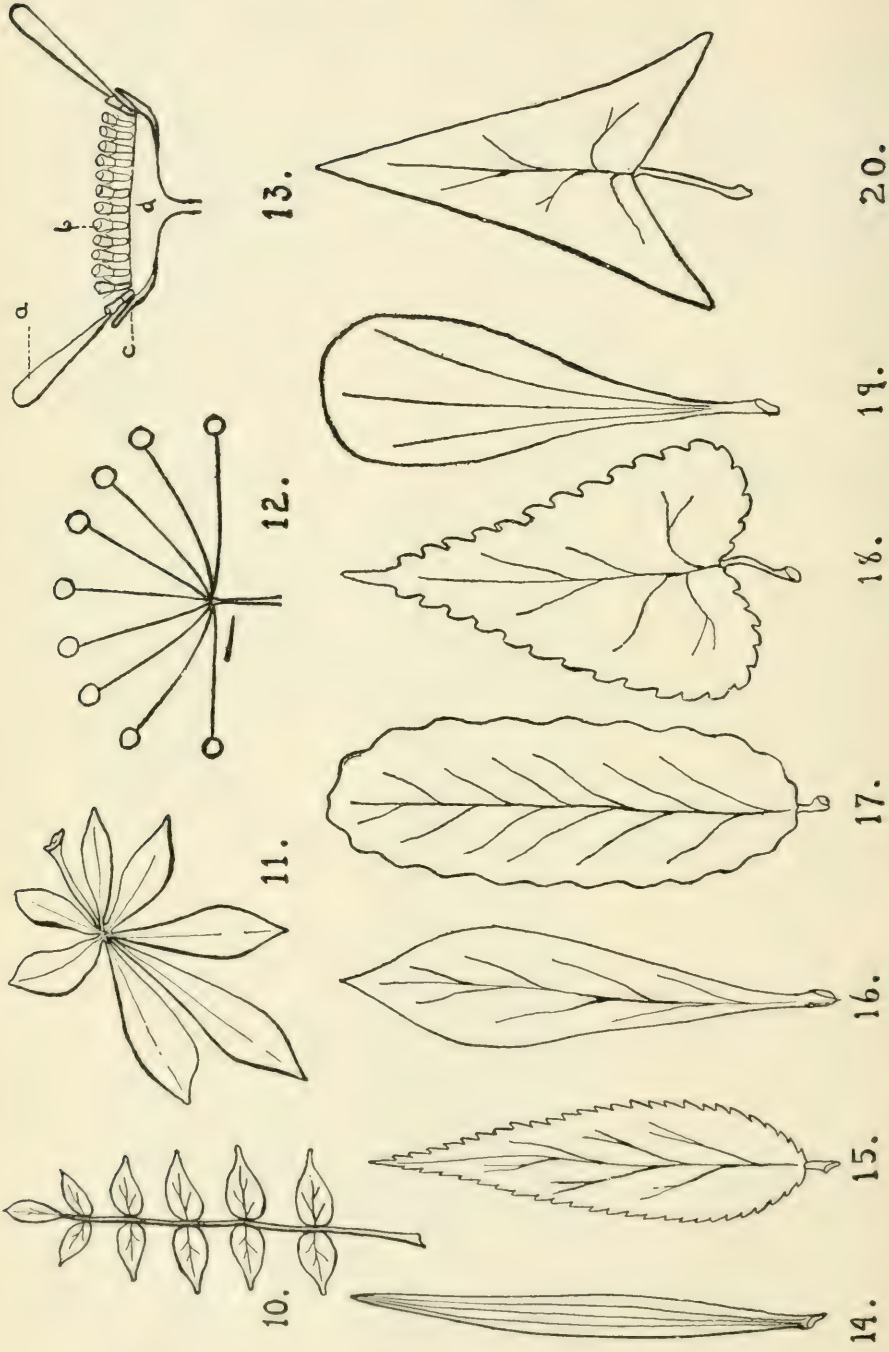
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Fig. 10.— *Pinnately compound leaf, as in locust, pea, hickory, and walnut*
Fig. 11.— *Palmately compound leaf, as in horse-chestnut, Virginia creeper, and poison ivy*
Fig. 12.— *Simple umbel, as in milkweed and cherry. The wild carrot has a compound umbel*
Fig. 13.— *Composite head: a — ray flower; b — disk flower; c — involucre; d — receptacle. The daisy has a composite head. The flowers may be all ray flowers, all disk flowers, or some ray and some disk*
Fig. 14.— *Linear leaf with parallel veins and entire margin, as in narrow-leaved spring beauty, blue-eyed grass, and cat-tail*
Fig. 15.— *Lanceolate leaf with netted veins and serrate margin, as in wild peppergrass*
Fig. 16.— *Oblanceolate leaf with entire margin*
Fig. 17.— *Oval leaf with undulate margin, as in witch-hazel*
Fig. 18.— *Cordate leaf with crenate margin, as in English violet*
Fig. 19.— *Spatulate leaf with palmate veins and entire margin*
Fig. 20.— *Hastate leaf, as some leaves of buckwheat and field bindweed*

do not always find all the parts present. Often, as in the anemone, one of the sets of the floral envelope is absent, and in that case the remaining set is considered the calyx. In many flowers the stamens are absent; in that case there occur also on the same plant, or on another plant of the same species, flowers with the pistils absent. In such plants the flowers are said to be *unisexual.* When pistils and stamens occur in separate flowers on the same plant, we say that the plant is *monœcious;* and when pistillate flowers (those without stamens) occur on one plant and staminate flowers (those without pistils) on another, we say that the plant is *diœcious.* In a *perfect* flower, the pistils and stamens are in the same flower.

Another variation that is commonly found has the parts of a series united. When the sepals are united we use the term *gamosepalous*, and when the petals are united we use the term *gamopetalous.* A good example of a gamopetalous flower is the morning-glory. The terms used in case the petals are separate and the sepals are separate are *polypetalous* and *polysepalous*, respectively. Besides finding the parts of a series united, we sometimes find the different series united. Different terms are used in these cases, also. When all the series are separate, as in Fig. 1, the flower is said to be *hypogynous.* The flower of a buttercup is hypogynous. It is rather common to find the calyx, corolla, and stamens united, as is shown in Fig. 2. In this case the term *perigynous* is used. When all the series are united, and the petals, stamens, and sepals seem to come from the top of the ovary, as in Fig. 3, we use the term *epigynous.* The common elderberry is epigynous. In the case of hypogynous flowers we say that the ovary is *superior*, since it is situated above the other parts. In the case of epigynous flowers we say that the ovary is *inferior*, because it is situated below the other parts. In case the anthers of the stamens are united, we use the term *syngenesious.*

In the foregoing have been given most of the terms used in describing the parts of a single flower. We shall now consider groups of flowers. A flower-bearing part of a plant or the plan of flower arrangement is called the *inflorescence.* The most simple type of inflorescence is the solitary arrangement, as shown in Fig. 4. Here one flower appears in the axil of the leaf and terminates growth in that direction.

If the flower is borne close to the main stem, and is without a stem or pedicel of its own, we say that the flower is *sessile.* This leads to the next form of inflorescence, the *spike.* In a spike we find a series of flowers that are sessile, or nearly so, arranged along a more or less elongated common axis (Fig. 5). The common blue vervain shows a good example of a spike. A form of spike that is fairly common is the *catkin.* A catkin is a flexuous, scaly spike, such as we find in poplars, birches, and the like. A catkin is illustrated in Fig. 6.

There is still another form of inflorescence in which the flowers are sessile. This is found in sunflowers and daisies and is called a *head*. The arrangement of clover flowers also is called a head. A sunflower head is called a composite head. In it, as is shown in Fig. 13, we find two kinds of flowers. The center flowers are short and densely massed together, and are called *disk flowers*. The outer flowers (a) are usually conspicuous and are called *ray flowers*. Outside of the ray flowers we find a series of green bracts, which apparently bind together the flowers of the head. This series of structures is called the *involucre*, and its parts are the *bracts of the involucre*. The broad structure on which the flowers are borne (d) is called the receptacle. A composite head may be composed entirely of ray flowers or the ray flowers may be entirely absent.

The remaining forms of inflorescence have the flowers borne on pedicels instead of being sessile. One of the simplest forms is the *raceme*, Fig. 7. In this case the flowers are borne on pedicels arranged along a common axis, as in a spike, the difference being that here the flowers are not sessile. In a raceme the lower flowers are the older, and usually the larger. Growth continues for an indefinite time and is said to be *indeterminate*. A *cyme* differs from a raceme in that the terminal flowers are the older and larger. New flowers appear below the old ones, and growth in length ceases with the first flowers. A growth of this type is called a *determinate* growth. A cyme is shown diagrammatically in Fig. 8.

In a cyme and a raceme the pedicels on which the flowers are borne are shorter than the main axis, and the flowers are arranged in a sort of pyramid. A form of inflorescence exists, however, in which the flower cluster is flat-topped, as in the common yarrow. This form of inflorescence is called a *corymb*. A corymb may be a determinate or an indeterminate form of inflorescence, in the general use of the term. In Fig. 9 is shown a determinate corymb.

In the forms previously described, the flowers have arisen from different points on the same or different axes. A form is found rather commonly, however, in which all the flower axes arise from the same point. Such an inflorescence is called an *umbel* and is shown in Fig. 12.

Various modifications of the above forms exist. A raceme, cyme, corymb, or umbel may be compound; that is, the axillary branches of an inflorescence may in turn be divided into the given type. A compound raceme of a loose, irregular nature is called a *panicle*.

Leaves are simple or compound. A simple leaf has but one blade. A compound leaf has more than one blade. The various types of leaves are illustrated on page 1284. There are other types, but most of the common forms are shown. Compound leaves are of two types, *pinnately compound* and *palmately compound*, as shown in Figs. 10 and 11. A pin-

nately compound leaf has the leaflets arranged along the main axis, arising from different points. A palmately compound leaf has the leaflets arising from the same point. If this is learned well it will be easy to remember the different types of leaf venation. These will be discussed later in the article. Leaves are considered as compound if the leaflets are distinct. If there seems to be a tendency toward division into leaflets, we say that the leaves are lobed. Here, again, we have two types, *pinnately lobed* and *palmately lobed*. A good example of a pinnately lobed leaf is the dandelion; of a palmately lobed leaf, the common sugar maple. The shapes of different leaves can best be shown by the diagrams. The commoner types of margins also are shown.

Leaf venation is interesting and important. The simplest type seems to be the *parallel-veined* type, shown in Fig. 14. Here the veins start at one end and extend along beside one another to the opposite end of the leaf. In case the veins start together and extend in the same direction but do not come together again, as in Fig. 19, the term *palmately veined* is used. In a large number of leaves, however, there is one main vein called the *midrib* from which smaller veins branch, as is shown in Fig. 17 in which case we use the term *pinnately veined*. Pinnately veined leaves and palmately veined leaves usually have many smaller veins branching in all directions from the larger veins and giving rise to the term *netted-veined*.

EDITORS' NOTE.— It requires some effort to learn to analyze flowers, but the pleasure and profit that result from the work, fully repay the student. Until a nature lover has scientifically analyzed plants, he cannot realize their remarkable structure. This line of study develops keen accuracy and observation. With each flower studied is renewed the wonder of life.

A person who is very skillful in anlayzing flowers recently stated that he had never studied botany in a school. He learned the meaning of botanical terms from Gray's Manual of Botany, and, in a few cases, asked the assistance of a high school teacher. By his own efforts he worked out the names of the majority of plants included in the wild flora of Pennsylvania; he analyzed the native trees by means of the key in Apgar's " Trees of Northern United States "; and when we talked with him, he was at work on the ferns, evidently finding great enjoyment in the study. He was looking forward to future work on the mosses, the grasses, and the sedges.

All natural history study becomes a resource that is wholesome and educational, and that increases a reverence for life. Any teacher who will prepare himself to direct the interests of boys and girls in the community along the lines of plant study may enter a social service that will be fundamental and far-reaching.

A FEW COMMON POISONOUS PLANTS

E. L. Palmer

In discussing poisonous plants many things must be taken into consideration. For example, we may separate the poisonous plants into two classes: those that are poisonous to the touch and those that are poisonous only when parts of them are eaten. In the first class we should place such plants as poison ivy and poison sumac. In the second class there is a larger group, including poison hemlock, nightshade, Jimson weed, and other plants. Again, some plants, such as poison ivy, are poisonous to some individuals while they are harmless to others. The plants described in this article are those that are comparatively

Poison ivy

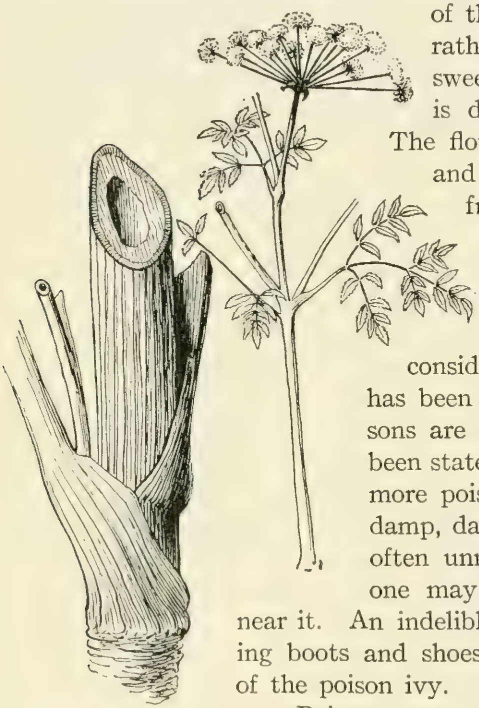
common in New York State and that have caused serious poisoning in several well-authenticated cases.

It might be of interest to note that all the plants mentioned have medicinal properties. In using them as drugs, however, they are administered in limited quantities only.

Plants poisonous to the touch. 1. Poison ivy, three-leaved ivy, poison oak, poison wine, mercury (*Rhus Toxicodendron*). Poison ivy is a common and well-known plant. It is especially abundant in rocky places, where it sometimes crowds out all other vegetation. In other places it twines about trees, fences, and the like, making a dense mass of vegetation

through which one who is susceptible to the poison of the plant cannot pass with safety.

The leaves of poison ivy are very characteristic. They are composed of three rather broad leaflets, the two lateral leaflets being smaller than the terminal one. It has been suggested that these three leaflets might be considered as a hand with one finger pointed in warning, while the leaf of the five-leaved ivy represents a hand spread open as a welcome. Some of the leaves of this plant resemble rather closely those of the bitter-sweet (*Solanum Dulcamara L.*), which is described later in this article. The flowers are rather inconspicuous and occur in loose clusters. The fruits are whitish or cream-colored, and are hard.



Poison hemlock

The poison given off by the poison ivy plant often causes an irritation of the skin and considerable nervous excitement. As has been mentioned before, certain persons are immune to the poison. It has been stated that the plant gives off much more poison during the night or during damp, dark days, and at such times it is often unnecessary to touch the plant, as one may be poisoned by merely going near it. An indelible ink and a varnish for finishing boots and shoes are made from the milky juice of the poison ivy.

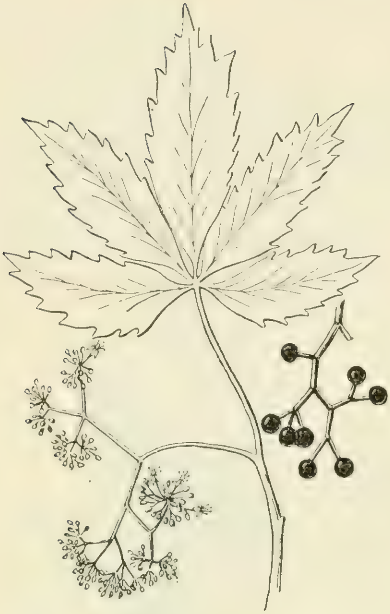
2. Poison sumac, swamp sumac, poison elder, poison or swamp dogwood, poison wood, poison ash, poison tree (*Rhus Vernix, L.*). The poison sumac is a smooth shrub three to thirty feet in height, and it is especially abundant in swampy places. The leaves of poison sumac are alternate and pinnately compound, that is, with numerous leaflets arranged opposite each other along a common axis. In this species there is always an odd number of leaflets, usually seven to thirteen. The flowers are clustered together loosely and are greenish white and rather inconspicuous. The fruit is globular and nearly white, and is prominent after the leaves have fallen from the plant. Poison sumac differs from poison ivy in that it is not a climber and in that it has seven to thirteen leaflets instead of three. The plant is probably our most dangerous poisonous species.

It is said that some persons who are immune to the attack of poison ivy are poisoned by poison sumac, and vice versa. The effect of poisoning by this plant is very similar to that by poison ivy. (See page 1290.)

Plants not poisonous to the touch, but poisonous if eaten. 1. Bittersweet, nightshade (*Solanum Dulcamara, L.*). This nightshade is particularly noticeable in fall, when the vines laden with bright red berries are conspicuous along the roadsides. The leaves are characteristic, being lobed or cleft at the base and appearing to be composed of one large leaflet with two smaller leaflets at the base. The flowers resemble potato blossoms, as they should, since this plant and the potato are very closely related. In the case of nightshade, however, the flowers are blue in color instead of white. The whole plant, except the flowers and fruits, has a deep greenish color, often with a slight purplish tinge. The fruits hang in rather loose clusters and are juicy. They are slightly longer than broad and, as has been said, are bright red in color. A case has been reported in which a four-years-old boy died within twenty-four hours after eating a number of the ripe berries.

Jimson weed
(*See page 1293*)

2. Black nightshade, deadly nightshade, common or garden nightshade (*Solanum nigrum, L.*). Black nightshade is very closely related to bittersweet. It is not, however, a climber and the leaves are of a different type. The fruits, too, differ in being nearly globose and dark blue or black in color. The flowers closely resemble those of bittersweet, but are white in color and much like potato blossoms. The leaves are somewhat diamond-shaped, with deep notches toward the end. They are usually full of holes made by insects or by fungous diseases. The poison of this plant is more deadly than that of the preceding species, many cases of death from eating the fruit having been reported. The Arabs



Virginia creeper

Black nightshade

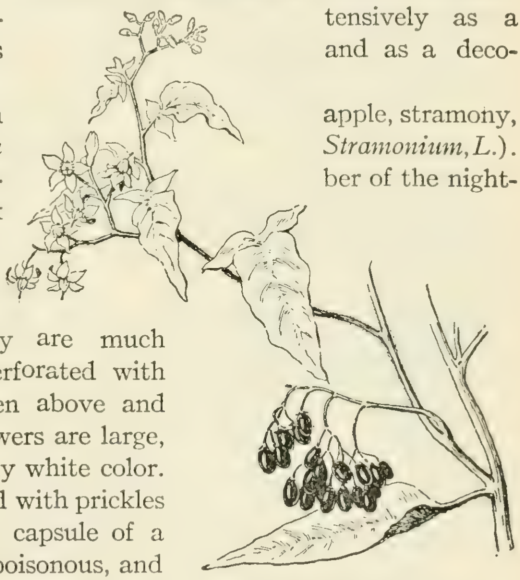
Water hemlock

Golden Alexanders

are said to have used the leaves as an application for burns, and the Bohemians are said to use the blossoms for inducing sleep.

3. Virginia creeper, American ivy, woodbine, false grape, wild wood vine (*Psedera quinquefolia*, [*L.*] Greene). The Virginia creeper is a member of a new family, the vine family. It is not a particularly poisonous plant, but the fruits, which appear tempting, often cause a severe sickness if eaten. As is suggested by the names, the plant is a climber. The characteristic leaves are composed of five leaflets radiating from a common stem, or petiole. The fruit is dark blue or black, globular, and borne in abruptly angled clusters. The plant is very common and is generally known, since it is used extensively as a cover for unsightly landmarks and as a decoration for porches.

4. Jimson weed, thorn apple, stramony, Jamestown weed (*Datura Stramonium*, *L.*). Jimson weed is another member of the nightshade family. Like the black nightshade, it is not a climber. The leaves are large and are shaped much like the leaf of the red oak, although they are much thicker and are usually perforated with holes. They are deep green above and pale green beneath. The flowers are large, funnel-shaped, and of a creamy white color. The capsule, or fruit, is coated with prickles and resembles somewhat the capsule of a poppy. The whole plant is poisonous, and if the leaves or fruit are eaten they cause a sort of foolish insanity. Death often follows. One of the antidotes against the poison is licorice root. Jimson weed is rather commonly found in gardens and waste places, especially where the ground is low. (See page 1291.)



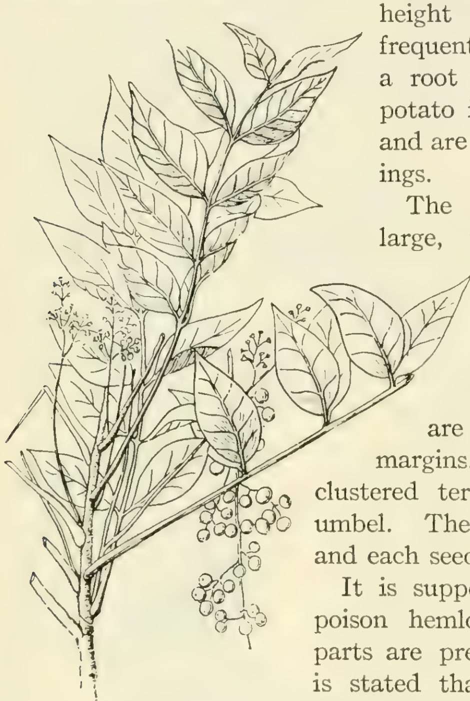
Nightshade (Bittersweet)

In connection with the last three plants mentioned, it may be of interest to know that the potato, tomato, eggplant, and tobacco belong to the same family.

Members of the parsley family.— The members of the parsley family are variable in their effect on the human race. Many, as the carrot, parsnip, parsley, and caraway, are cultivated for culinary purposes, while others are deadly poisonous. In general the members of this family may be described as herbs with alternate compound leaves and with small flowers usually collected in compound umbels. In a compound

umbel the flowers are on short stalks which radiate from a common stem, while many of these clusters are on stalks which in turn radiate from a common point. The fruits are composed of two dry, seed-like structures cohering by their inner faces.

5. Poison hemlock, stinkweed, spotted poison parsley, herb bennet (*Conium maculatum*, *L.*). This member of the parsley family grows to a height of two to six feet. It grows frequently in moist waste places and has a root stalk which resembles a sweet potato in shape. The stems are hollow and are coarsely spotted with red splashings.



Poison sumac
(*See page 194*)

The leaves of poison hemlock are large, many times compound, and widely spreading. The stalks of the leaves, or petioles, clasp the stem with a very pronounced sheath. The leaflets are comparatively small and are acutely and deeply cut on the margins. The flowers are white and are clustered terminally in a dense compound umbel. The fruits are somewhat flattened and each seed has five lateral ribs.

It is supposed that it was a tincture of poison hemlock that Socrates drank. All parts are presumably poisonous, although it is stated that some persons have eaten the plant without ill effects. Paralysis followed by death without pain is the usual result of eating the plant.

6. Golden Alexanders, meadow parsnip, golden parsnip, round heart (*Zizia aurea*, [*L.*] Koch). This member of the parsley family is found commonly in meadows and woods. It differs from the other species mentioned in having deep yellow flowers, which are borne in a compact umbel. The leaves are comparatively short, while the leaflets are comparatively broad. The fruits are about one fourth inch long and rather slender. This is probably not so venomous a poison as the poison hemlock or the water hemlock.

7. Water hemlock, snakeweed, beaver poison, musquash root, spotted cowbane, children's bane, death of man (*Cicuta maculata*, *L.*). This plant is often mistaken for some other plant and is eaten unintentionally.

Numerous cases are reported in which it has been eaten for artichoke. The roots of water hemlock secrete a yellowish, pungent oil which should warn any one who might mistake it; and, besides, the position of the roots in the two plants is different. In artichoke, the roots are attached to the parent plant at the narrower end and by spring are usually separated by decay; while in water hemlock the roots are clustered with the larger ends together and remain near each other.

The leaves of water hemlock are two or three times pinnate, the lower ones being on long stems. The leaflets have notched margins, are about three times as long as broad, and are comparatively long pointed. The fruits are about one eighth of an inch long and are borne in the characteristic compound umbel. Poisoning by this plant generally results in death.

A WORD ABOUT AN HERBARIUM

THE EDITORS

Nearly all boys and girls take an interest in making collections of flowers, and it is wise to encourage them to become familiar with the wild flora of the neighborhood by collecting and pressing different plants that grow in the woods and along the wayside.

In order to be of the greatest value, the herbaceous specimens should show the entire plant including the root. It requires much labor and experience to press an entire plant, however, and therefore in the beginning it might be well to encourage children to make small pressed specimens of the blossoms. These specimens are attractive and frequently increase the interest of the children if they are mounted and named after they have been thoroughly dried. They can be used for review work in learning the names of the common plants found about the school and farm home.

In one rural school some very remarkable specimens of pressed flowers were made with ordinary materials that are at hand in any community. The teacher had two strong boards, a good collection of newspapers, and a large stone to be used in pressing the plants. The boys and girls were asked to bring a few specimens each day, of which not more than twelve were used. The specimens were placed between the newspapers and the newspapers were gathered in a pile. One of the boards was placed beneath the pile of papers, and the other on the top. The large stone was then used for a weight.

In this work the pupils were taught that in order to obtain good herbarium specimens the plants must be dried quickly and thoroughly. The children soon realized the importance of changing the newspapers frequently until the moisture was entirely removed from the plants. The specimens were then mounted on white drawing paper.

PLANTING OF RURAL SCHOOL GROUNDS

EDWARD G. LAWSON

Sketch of school building and surroundings

The surroundings of many rural schools are bare and harsh, and have an atmosphere of cheerlessness and coldness about them which indirectly has an undesirable effect on the general interest of the children. There should be a homelike atmosphere about the school, both within and without, which will express comfort and beauty.

The planting about the model schoolhouse on the campus of the College of Agriculture at Cornell University furnishes suggestions for planting school grounds. It is simple in design and is suited to its surroundings. The shrubbery is massed about the building in an irregular, curved border. The material used is mostly nursery stock, such as spiræa, golden bell, viburnum, lilac, barberry, red-twigged dogwood, and roses.

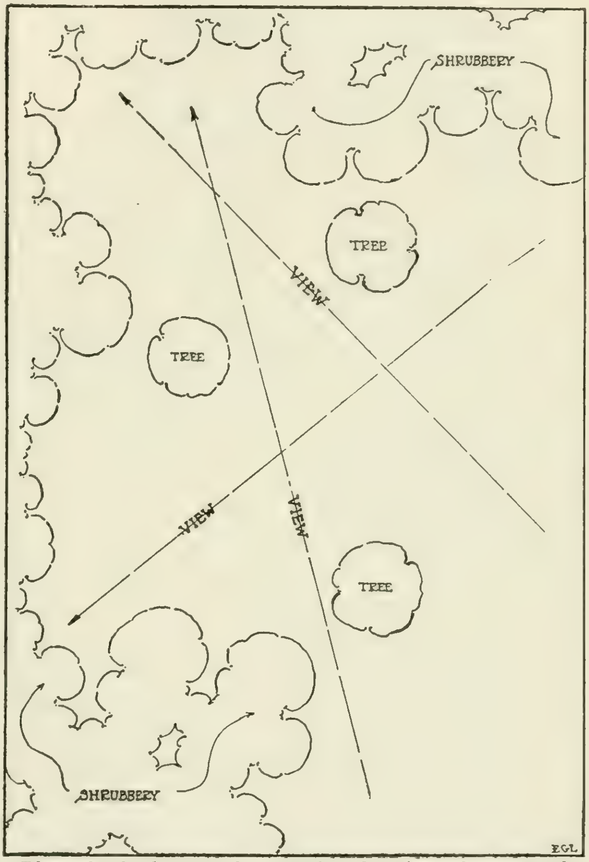
If a teacher is ready to begin the planting of school grounds, the first step is to make a definite plan on paper. Four lines should represent the borders of the school grounds. The schoolhouse and the outbuildings should be indicated and the trees may be located by small circles.

The first fixed point for consideration is the front door; the second fixed point is the place or places at which the children enter the grounds. These points should be joined by the most direct and the simplest curve possible. In most cases the schoolhouse is so near the highway that a straight walk is most advisable.

The planting should be massed about the corners of the buildings and the borders of the grounds, leaving the center of the place open for lawn. The position of two or three trees may be indicated near the schoolhouse

and near the border planting of shrubbery, as shown in the illustration. Vistas should be left open to distant views, such as beautiful hills, church spires, well-cultivated fields, fine old trees, brooks, or attractive farmhouses. The planting should be in irregular borders, with lower bushes in the front and taller ones in the rear.

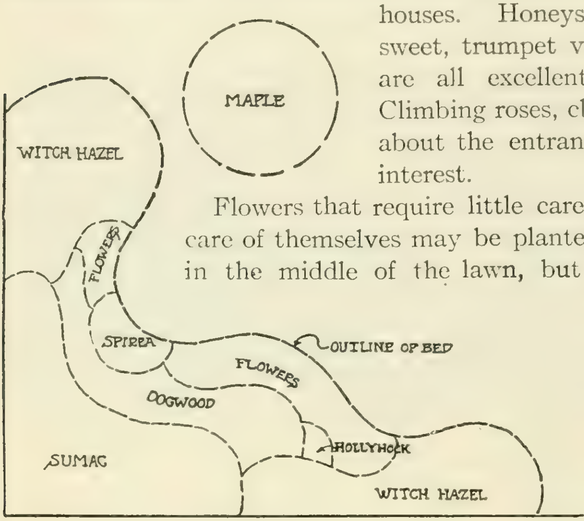
The selection of plants should be made for their foliage effects, so as to give the place a heavy border mass of green. Flowers are for decorative purposes and are of a temporary nature. The selection of trees, shrubs, and vines should include the more common varieties, because they are hardy, less expensive, and more likely to grow. It is strongly suggested that materials for planting be collected from woods, old yards, fields, and near-by fences, instead of being bought as nursery stock. The planting list should be kept down to a minimum number of the varieties that will be named later.



Plan of school grounds, showing location of trees and border planting

A selection from the following trees is suggested: maple, elm, ash, buttonwood, oak, hickory, pine, spruce, and hemlock. For shrubs, the common plants to be found in the woods and swales, together with roots that can be found in every old farmyard, should be used: willow, witch-hazel, flowering dogwood, red-twigged dogwood, thorn apple, elder, sumac, wild honeysuckle, and high bush cranberry — these and others can be found in every school district. From farmyards can be procured snowball, spiræa, lilac, forsythia, mock orange, roses, snowberries, and barberry.

Vines can be used to excellent purpose for covering the school building, the outbuildings, and the fences if there are any. The Virginia creeper is very common. The Boston ivy may be used on brick or stone schoolhouses. Honeysuckle, clematis, bittersweet, trumpet vine, and climbing roses are all excellent for vine treatment. Climbing roses, clematis, and bittersweet about the entrance will give color and interest.



Plan of irregular border planting

Flowers that require little care and that largely take care of themselves may be planted — not in flower beds in the middle of the lawn, but in the borders of the massed planting. A flower garden may be made by itself in the inclosed area, but this requires much work and continued interest on the part of the children. For a garden of this kind, perennial plants — those that live from year to year — are excellent. Of these, day lilies, bleeding hearts, peonies, pinks, bluebells, hollyhocks, perennial phlox, sweet william, and hibiscus are excellent. From the fields may be collected daisies, asters, goldenrod, and violets. These will grow well, and they improve when grown in rich ground and given plenty of room. They will provide spring or fall bloom.

Imagine a school ground planted with early spring bulbs! And why not? Picture a schoolyard in early spring with touches of color created by a few clumps of crocuses, daffodils, tulips, and lilies of the valley!

L. H. Bailey writes: "While the main planting should be made up of common trees and shrubs, a rare or strange plant may be introduced now and then from nurseries if there is any money with which to buy such things. Plant it at some conspicuous point just in front of the border, where it will show off well, be out of the way, and have some relation to the rest of the planting."

Think of a little clump of spiræa or golden bell covered with bright color in spring, with a background of dark, rich green shrubbery-massing or a heavy spray of red-twigged dogwood or the yellow fall blossoms of witch-hazel! These are the elements that make a schoolyard attractive and that show pride and interest in the school district. Let us have them by all means.

Open lawn with irregular border

To-day is the time to begin. Measure the grounds and take note of existing conditions. Outline the place on paper and make the planting plan. Should it be impossible to plant the whole grounds next spring, make a start and plant in some shrubs and trees as designed in the plan, and then complete the planting in the fall. It will prove to be not a task, but a delightful pastime. Then watch the added interest and zeal of the children.

Brief outline of steps to be taken in this movement:

1. Obtain the interest of children, parents, and school board.
2. Make a survey of grounds and study existing conditions.
3. Transfer the survey to paper and design planting.
4. Fertilize the ground heavily, plow, and grade.
5. Transfer the design from the plan to the grounds.
6. Collect material for planting.
7. If some stock is to be bought, order it from some reliable nursery. Should a reliable nursery be unknown, write to the College for suggestions.
8. Plant trees and shrubs, then flowers and bulbs.
9. Prepare and sow lawn, if this does not exist.
10. Teach the children to love and take pride in their school grounds.
11. Inform the College of your accomplishments.
12. If in doubt, send survey of grounds and list of material that can be collected and we will give suggestions.

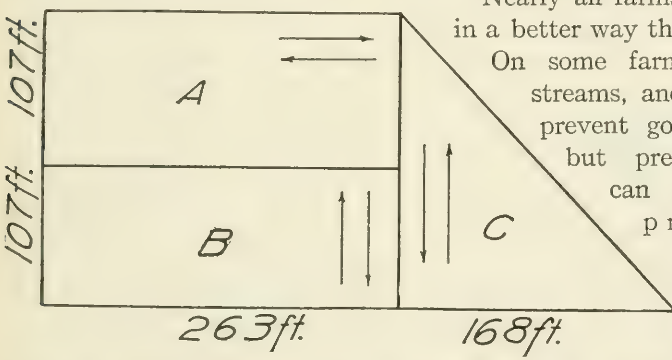
Planting sketch of school grounds

FARM MAPS AND FARM LAYOUT

G. F. WARREN

One of the most important problems in farm management is the question of field arrangement. Most of the farms of New York were laid out in the days of scythe and grain cradle. With hand tools, irregular small fields were not so much of an obstacle as they are now that the work is done with machinery. Many farms have been enlarged by the purchase of more land. This also raises the question of farm layout, for when two farms are combined there are usually twice too many fields.

For farming purposes it is desirable that the fields should have square corners and that they should be longer than they are wide. Permanent pastures are most cheaply fenced when they are square.



Nearly all farms can be laid out in a better way than they are now. On some farms stone walls, streams, and other obstacles prevent good arrangement, but present conditions can usually be improved. In general, the changes cannot be made at once. It is therefore necessary to make a farm plan, so that whenever changes are made the owner will be working toward the ultimate plan.

Exercises such as No. 4 and No. 5, given below, will do much to call attention to the importance of this question. The work will be good educational training for the children. The father should be consulted so that he will be interested. The corrected map should be one that he will accept as practical for conditions on the farm.

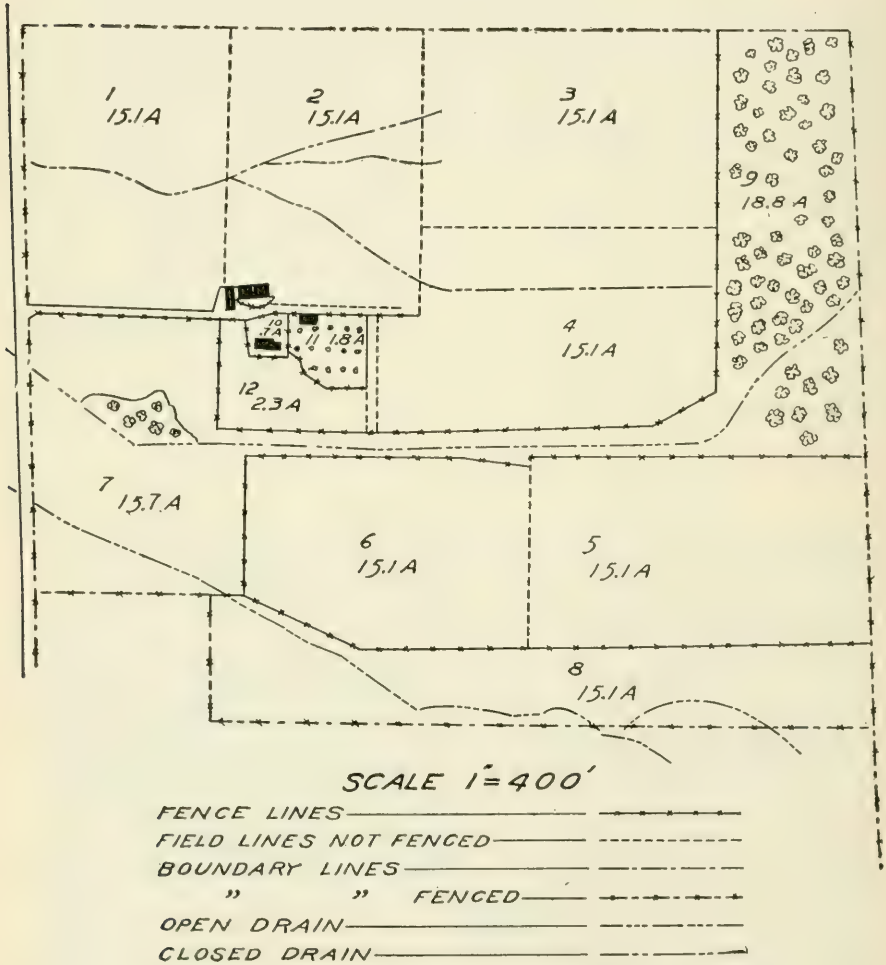
EXERCISES

1. How many rods of fence will it take to inclose a square field of one acre? How many rods to inclose a square field containing forty acres? How many rods is this per acre?

2. If the repairs and the depreciation on fence and posts cost five cents per rod each year, what will be the cost per acre each year to keep the one-acre field fenced? The forty-acre field?

3. In order to determine the influence of length of the grounds and shape of the field on cost of plowing, fields A, B, and C were plowed with a

fourteen-inch plow in the directions indicated. It took two hundred and eighteen minutes to plow A, two hundred and forty-eight minutes to plow B, and one hundred and seventy minutes to plow C. At what rate per acre was each plowed? What per cent more time did it take to plow B than A? C than A? The average length of C is the same as B; why did it require so much more time?



Map of the farm of Franklin C. Cornell, Ithaca, New York

4. Make a map of your home farm like the map on page 206. In each field give the crops grown last year and the crops that will be grown next year.

5. Make a new plan for the farm, showing any changes in field lines that you think could be made with profit.

REFERENCE BOOKS

1. Nature-Study and Elementary Agriculture

Nature-study leaflets (bound volume). Extension Department, College of Agriculture, Ithaca, New York	$ .30
The nature-study idea. Bailey. The Macmillan Company, New York	1.25
Nature-study and life. Hodge. Ginn & Co., Boston	1.50
Handbook of nature-study. Comstock. Comstock Publishing Company, Ithaca, New York. Postage 35 cents	3.25
Elements of agriculture. Warren. The Macmillan Company, New York	1.10
Agriculture for beginners. Burkett, Stevens, and Hill. Ginn & Co., Boston	.75
Beginnings in agriculture. Mann. The Macmillan Company, New York	.75
New elementary agriculture. Bessey and others. University Publishing Company, Lincoln, Nebraska	.60
The great world's farm. Gaye. The Macmillan Company, New York	1.00
Sharp eyes. Gibson. Harper & Bros., New York	2.50
Eye spy. Gibson. Harper & Bros., New York	2.50

2. Plant Life

Manual of botany. Gray. American Book Company, New York	2.50
Our native trees. Keeler. Charles Scribner's Sons, New York	2.00
Trees of northern United States. Apgar. American Book Company, New York	1.00
A first book of forestry. Roth. Ginn & Co., Boston	.75
Manual of gardening. Bailey. The Macmillan Company, New York	2.00
Garden-making. Bailey. The Macmillan Company, New York	1.00
Cereals in America. Hunt. Orange Judd Company, New York.	1.75
Field book of American wild flowers. Matthews. G. P. Putnam's Sons, New York	1.75

How to know ferns. Parsons. Charles Scribner's Sons, New York	$1.50
Mushrooms. Atkinson. Henry Holt & Co., New York	2.50

3. Animal Life

Handbook of birds of eastern North America. Chapman. D. Appleton & Co., New York	3.00
Bird neighbors. Blanchan. Doubleday, Page & Co., New York.	2.00
Bird homes. Dugmore. Doubleday, Page & Co., New York	2.00
Manual of the vertebrates. Jordan. A. C. McClurg & Co., New York	2.00
American animals. Stone and Cram. Doubleday, Page & Co., New York	3.00
American food and game fishes. Jordan and Everman. Doubleday, Page & Co., New York	4.00
The reptile book. Ditmar. Doubleday, Page & Co., New York	4.00
Types and breeds of farm animals. Plumb. Ginn & Co., Boston	2.00
Feeds and feeding. Henry. W. A. Henry, Madison, Wisconsin.	2.00
Milk and its products. Wing. The Macmillan Company, New York	1.50
The horse. Roberts. The Macmillan Company, New York	1.25
Insect life. Comstock. D. Appleton & Co., New York	1.75
Moths and butterflies. Dickerson. Ginn & Co., Boston	1.25
The spider book. Comstock. Doubleday, Page & Co., New York	4.00

4. Earth Science and Astronomy

New physical geography. Tarr. The Macmillan Company, New York	1.00
Soils. King. The Macmillan Company, New York	1.50
The children's book of stars. Mitton. The Macmillan Company, New York	2.00

5. Nature Poetry

A child's garden of verses. Stevenson. Charles Scribner's Sons, New York	.50
Songs of nature. Edited by John Burroughs. McClure, Phillips & Co., New York	1.20

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IMPORTANT NOTICE

READ CAREFULLY ARTICLE ON PAGE 1270

Two or three leaflets for boys and girls will be sent during the year to the elementary schools that are supervised by district superintendents. We have not sufficient funds to send children's leaflets to city schools.

Your boys and girls should have the leaflets. Please write their names and the other information called for on this sheet and send it to

(Miss) Alice G. McCloskey
College of Agriculture
Ithaca, New York

Teacher's name..

Post-office address..

....

Number of school district..

Name of township..

Name of county..

Name of district superintendent..

Number of teachers in the school..

Number of pupils in your charge..

NAMES OF PUPILS

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The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

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SAVING STRENGTH

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A woman once said, " I have so much to do I don't know what to do first; so I think I will take my nap and get so much off my mind." She was, unconsciously, a good philosopher, for the nap enabled her to get through her duties without worry and fatigue, actually more tiring than work itself.

Our observation of most women indicates that they want not less to do, but more health and strength with which to labor. The average woman wastes nervous energy over unaccomplished work. The practice of exercises described in this bulletin may help women to work with increasingly good results yet with less fatigue.

To suggest to those who in their daily occupations are usually " on the go," not only from sunrise to sunset but for several hours more, that physical culture would be a good thing for them, seems at first impression nothing less than an absurdity. One can almost hear the answer that such a suggestion would call forth from many a busy, energetic woman, as well as from many a tired, overworked woman: " Exercise! Physical culture! What nonsense! I have exercise in my work." Or, " I think I could give these physical culture teachers a few lessons myself. Let them get the meals for my large family, do my washing and ironing, take care of my house, tend my dairy, feed my chickens, and they would not need any fancy exercises! " Or the weary woman sighs: " What I want is a chance to rest, to get strong again. Don't talk to me about more exercise." Such reasoning seems sound. It would be essentially true if physical culture meant an increase of the same kind of exercise that is necessary in the performance of one's daily work. But the physical culture herein suggested means something very different. The farmer and the wife often need some kind of physical exercise that will tend to correct the physical faults of

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their daily occupation. The existence of worn, crooked, and prematurely old men and women is proof enough that physical betterment is needed.

Doubtless some overworked woman has already said to herself, if not aloud: "There's no use talking to me about physical culture, even if it is a good thing. I've so much work to do, I've no time to learn anything." If an old, worn-out stove will burn up twice as much fuel yet give out but

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FIG. 1.—*Depressed in mind and body*

two thirds as much heat as would a new stove, it is a *saving of money* to spend money for a new stove. Likewise, if in using the body in an incorrect way more nervous energy is consumed and less work accomplished than would be in using it correctly, it is plainly a *saving of time* to take time to learn how to use the body more economically.

Of course it is not asserted that by means of physical culture one can lessen the actual amount of a day's work; but it is maintained that an acquaintance with practical physical culture will enable women *greatly to lessen the fatigue* attendant on their work.

HOW TO SAFEGUARD THE BODY

Rest and relaxation are necessary for health.— One of the first things that many persons need to do is to get rested; then the mountain of work and

FROM PAINTING BY BRETON

Song of the Lark

Fig. 2.—*Alert in mind and body*

worry will melt away into a possibility of accomplishment. There are women who would not be caught napping in the daytime and who would be afraid to be found sitting in an easy-chair in the forenoon. Still, it may be a clear gain of time to indulge in such resting periods, and the couch and the easy-chair should be frequently used.

Oftentimes we spend as much energy in useless effort to get things done when we do not feel like doing them as in the accomplishment of much more when we are fit for it. We are more satisfied with work done in the morning when we are fresh, than we are likely to be with that done later in the day when the spirit lags from want of strength.

It has been noted by housewives that perhaps just before dinner, when the family is expected home, or at any other critical moment in the day's work, a nervous tension is invited which wearies more than does actual work. One way to get along at such a time is to screw up the nervous energy a little harder and try to go through the ordeal of being the leading spirit in the household and at the same time seeing that the dinner is on the table in good condition and properly served; quite a different way is to relax physically, and by such relaxing throw off nervous tension with the belief that everything will come out all right and that even if there are mistakes they are not serious. During such relaxation is a good time to use the rocking-chair, to close the eyes, relax the jaw, rest the head on the chest, and become possessed with the idea that "all's right with the world."

Repose settles very gracefully upon a housewife. The other members of the family do not always come home with the spirit of helpfulness and cheerfulness, and when a woman finds it necessary to be the pacifier or the encourager it will be a time for her to call upon her reserve power of strength. She therefore needs to store up energy for the unexpected, because emergencies are always having to be met in the household. If she does not plan for the unusual, the unusual is likely to be the "straw that breaks the camel's back." Remember the Jamaican couplet:

> "Doan run too fas' wi' dat load o' limes;
> Ef you run too fas', you will run two times."

Rest for a minute.— The wise woman will not fail to take a few minutes for rest several times during even her busiest and most taxing day. Indeed, it is on just such a day that she most needs to practice the beneficial gospel of relaxation. To relax — to let go the nerve, brain, and muscle strain — for even sixty seconds is a positive gain to the entire system. Complete relaxation and thorough rest are most easily obtained by lying down and unreservedly yielding the support of the body to the couch. Thus to spend five or ten minutes in the middle of each day would enable many a

worn and weary house-worker to *accomplish more*, with less fatigue, than is otherwise possible. The foregoing suggestion is so remote from what many an industrious woman considers "her duty to her family" as to seem to her like *theoretical nonsense*. Nevertheless, it is body- and brain-saving, good, common sense. *Duty to oneself* should lead women to take measures for saving health and strength while there is still a fund to draw upon.

Rest periods of fifteen minutes at intervals during the day are much to be desired in the housekeeper's program, and they should be taken before she has become so weary that fifteen minutes do not seem to count. A hard-working professional man was asked how often he rested. He replied, as often as he had fifteen minutes to spare. Women do not rest often enough before they are utterly exhausted. Sometimes it seems easier to continue working than to stop, because the first experiences in resting are most uncomfortable; one dreads the let-down after utter exhaustion. Moreover, young housekeepers full of life and energy are tempted to work beyond their strength without planning for the reserve necessary for later years.

Vacations cost less and are much more to be enjoyed when one is in condition to appreciate them than at other times. No one needs a vacation more than does a housekeeper. Everything is brighter and more encouraging on her return, and her family feels the benefit that has come to her from a fresh point of view and a rested spirit. Homemakers probably find it more difficult than do many others to leave their work, even for a day or two, and, when it is suggested that they have a change for two weeks, are appalled at the thought of leaving their home duties.

The daily vacation.— It is very restful to sit for ten minutes visiting with some one, or even with folded hands, if one's leisure is not enforced. But as soon as one becomes aware that the dinner may be late because of trouble with the kitchen fire or because of some interruption, every delay becomes wearisome. It is not always possible in a household to have helpers do things on time and accomplish results successfully, and the average woman is worried by waiting for others to gain results or to travel as fast as she wants to. Worrying over such conditions is a difficult habit to overcome; yet it causes much waste energy. The satisfaction of doing all that is possible is really the only necessary requirement, and, if one can drop the worry over work not accomplished, much is gained in poise.

Anticipated discomforts are to be avoided.— We unfit ourselves for duties that we wish to accomplish by the fear that we shall fail in them. If one is called upon to act as hostess under trying circumstances or to speak at the farmers' wives' club, the anticipation of her duty is much harder than its accomplishment. But who has suggested failure? It is she who is to

perform the part, who says, "I am afraid I am going to fail." The fear of failure is a prompt invitation to fail. To entertain this idea of failure is almost sure to bring about direful results, and because of such an idea many refuse to perform a duty that would afterwards be a source of satisfaction. If one does not allow the idea of failure to enter the mind, or, if it does, drives it out immediately, there is great promise of success. There is much in the philosophy of abandon in work; when, letting results come as they will, one may be sure of doing the best that is possible.

Relation of bodily actions and attitudes to mental states.— Mental and emotional states are inevitably more or less influenced by bodily condition and activities. A dejected physical attitude tends to develop a dejected mental state. On the other hand, there is nothing more effective for ridding oneself of "the blues" than to stretch the body to its full height, to breathe deeply, and to express lightness and joyousness in bodily action; to recall some witty saying and laugh over it again, or sing a bit of some merry song, or run gaily out to the barn and call the chickens in cheerful tones, or take a few steps of the dance that one delighted in before one married and "settled down." That "settling down" physically and mentally is perhaps the thing of all things that it is most essential to protect oneself against.

How significant is such a remark as "bowed down with grief" or, if a man has been unfortunate, "he has grown ten years older in a week"! Grief, if yielded to, does bow the body down; so does trouble of all sorts. When things seem to be going all wrong and we have begun to take a solemn attitude toward everyday incidentals, the habit of working the muscles into a smile or a laugh will bring a comfortable inward feeling which really means inward happiness. We generally laugh because we are glad, but psychologists tell us that we shall be glad because we laugh; and if the more natural method of laughing because we are glad has been neglected, it may be well to learn to be glad because we laugh. I knew one woman who had a habit, when there was forewarning of a domestic storm, of relaxing the muscles of her face into a smile and even of laughing heartily. This may have been a nervous reaction, but it worked like a charm upon the family and the children knew that when the mother's sides were shaking, discord would be disarmed.

Depressed mental states have an involuntary restrictive effect on all the vital processes. To be "blue" or sad or despondent is to have the breathing, the circulation, and the innervation of the body less than normal — the latter to such an extent that not enough nervous energy is sent to the muscles to give them tone and vigor. The results are that the muscles become unduly relaxed, the chest sinks, the head droops, and the feet and legs drag. One must summon the will to the rescue. The inert muscles

and heavy body must be energized and invigorated. The very effort made in thus taking oneself in hand and holding the body bravely erect, affects the mental state wholesomely. Courage begins to replace despondency. When everything seems topsy-turvy and your feelings are correspondingly crisscross, instead of clouding the day with irritability, or grieving some one by an angry word or unkind tone, try a simple physical culture remedy: stand perfectly still for a full minute; breathe full and deep; let go the tension in the muscles, loosen the hard-set jaw, smooth out the forehead frown; let go physically, and the mental let-go will follow.

Every one admires a woman who is reposeful.— A well-poised woman has greater efficiency and a greater power over others than does one with less poise.

HOW TO USE THE BODY

The backbone: its great importance in the correct use of the body.— Few appreciate how much health, strength, and endurance, how much ease in work and youthfulness of figure, depend on the backbone. When that wonderful twenty-four-jointed column of bones is in its natural position it forms a double curve (Fig. 3). That double-curved line is the line of greatest strength and flexibility. It is also the line of beauty. On the maintenance of the double curve in the spine, the attitude of the body as a whole and the correct positions of all the vital organs primarily depend. Although the double-curved line is the right line for the backbone always to keep when the body is simply erect — either in a standing or sitting posture — deviations from that line are continually occurring during the manifold movements of the body.

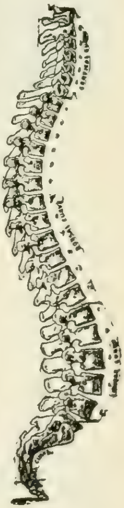

FIG. 3

The adjustability of the spine to the movement desired is of great service in the use of our bodily machine, but we must be sure to *bring the spine back to its natural pose* — the double curve — after every act that causes it to bend or twist; the failure to do so is one of the chief causes of the aging of the body, of undue fatigue from work, and of the ills that flesh is *not* "heir to."

Injurious and healthful ways of using the body.— A tall, thin woman is represented in Fig. 4 in what is a very common standing position — the back bowed outward in a single curve, the chest and abdominal muscles collapsed. The same general bad use of the body is seen in a sitting position, Fig. 6 (a). Such positions compress the ribs and disastrously interfere with the three indispensable vital functions of life — respiration, circulation, and digestion. The chest is cramped and sunken, making full, invigorating breathing impossible; the circulation is impeded by pressure on the veins and arteries, caused by the sagging of the heavy upper trunk;

while the stomach, as a well-known physician has said, "is literally crowded out of house and home."


FIG. 4 FIG. 5

A woman of medium height, inclined to be stout, is represented in Fig. 7 in another bad position. The upper part of her trunk is thrust too far back, the lower part too far forward. This makes the abdomen protrude and flattens the lower part of the spine. Women who stand thus complain of having a "flat back" and of "needing a little bustle to give them any shape."

Worst of all, in both the bad positions sketched, all the supporting muscles of the trunk are incorrectly and injuriously used. Strain is brought on the muscles of the lower back — the internal as well as the external muscles — frequently causing backache; while the front waist muscles and the abdominal muscles are more or less relaxed, whereas, of all the muscles of the body, they are required to do the most important work of supporting the vital organs and should be especially firm and strong. Other results of such bad uses of the body are heaviness of movement, unnecessary fatigue, and, frequently, nervousness and serious pelvic troubles.

(a) FIG. 6 (b)

The normal, true attitudes in standing are shown in Figs. 5 and 8. In these illustrations the body is shown so poised that the back maintains its natural double curve (Fig. 10) and

the upper part of the trunk (the chest and bust) is in advance of the lower part (the abdomen).

In both the bad standing positions illustrated, a line extending from the toe-tips vertically upward would touch the abdomen and be several inches from the chest (Fig. 9). In the good standing positions the line would clear the abdomen and touch the chest (Fig. 10). This line test is one of the best simple tests of a good poise of the body.

FIG. 7 FIG. 8

In order to change from Fig. 9 to Fig. 10, one should stand as alertly erect as possible and by a motion at the hip joints sway the trunk forward until the chest is in line with the toe-tips. The swaying motion should be done easily, without strain or tension. One who is accustomed to a bad poise of the body may feel at first, in assuming this normal poise, as though she were about to fall forward. *Standing tall*, "erect under the stars," and keeping the head well up will soon overcome such a sensation. Note the points in favor of the position: (1) The waist and abdominal muscles are firm instead of being weakly relaxed. (2) The vital organs are well supported. (3) Every part of the body is unrestricted, there being no cramping, crowding, nor sagging of any of the parts. (4) The center of gravity is over the balls of the feet, which is essential for light, easy walking. (5) The chest is high and active instead of being narrow and depressed. (6) The shoulders are flattened instead of being "round." (7) Each part of the body is in balanced relation to all other parts, so that all the muscles are free from strain or tension.

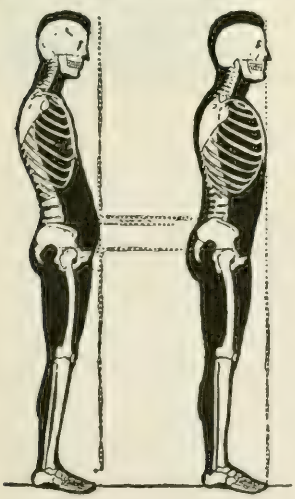

FIG. 9 FIG. 10

These are the conditions for health, lightness of movement, physical endurance, work with the least fatigue, and uplift and joyousness of spirit.

Bend from the hips, not from the back.— The right poise of the body is the first great essential in physical economy. After that, nothing is more important to housekeepers than to know how to bend and stoop with the least strain, the least expenditure of nervous energy, and the least interference with the vital functions. Every woman will recognize the too familiar bend and stoop from the shoulders and back — with an accompanying break at the waistline in front — seen in the woman washing dishes (Fig. 11), in the woman washing clothes (Fig. 12), and in the woman picking up something from the floor (Fig. 13).

FIG. 11

Nature's bending places are the hip joints and the knees. When we ignore the hip joints and the knees and put their legitimate work on the back, Nature resents our failure to cooperate with her. She "gets even" with us by enfeebling the digestion, by making the back bowed, old, and weak and the body heavy and set, and by otherwise "stealing away our youth and health unawares." The office of the muscles of the back is primarily to keep the trunk of the body normally erect. In leaning somewhat forward, as in sweeping (Fig. 14), in washing (Fig. 15), in all kitchen-table work — such as kneading bread, rolling pie crusts, preparing vegetables, and washing dishes (Fig. 16) — let the movement be from the hips, keeping the back in nearly the same position that it has when one stands easily erect (Figs. 5 and 8). In stooping to pick up something from the floor, the knees should bend and the large muscles of the legs should carry the body and arms down within reach of the object desired. The ugly and fatiguing way to pick up an object is to strain the back and cramp the pelvic organs, as in Fig. 13.

FIG. 12

FIG. 13

In order that there may not be *some* undue strain, even when one bends forward from the hips in the right way, kitchen tables, ironing boards, sinks, and washtub stands should be made considerably higher than they usually are. A table too low for a woman's height causes her, almost unavoidably, to sin against her health and comfort. Tables

should be made to fit the women who work at them; women should not be obliged to fit their height to tables. It may be argued in favor of the low table for general use, that some women are short and so could not work at a high table, whereas a tall woman can accommodate herself to a low table by stooping. Of course, the *best* worktable is that which suits the worker's height; but if two women of marked difference in height must use the same table, then it is much better for the shorter woman in her work to reach somewhat upward — as we have seen little children do — than for the taller woman to stoop to any considerable degree. For the shorter woman a stool or step may be placed in front of the worktable, the ironing board, or the bench used for the washtub. For her to make the big, sturdy leg-muscles do a little extra work in taking a step upward to her work is far better than for the taller woman to jeopardize her health, her powers of daily endurance, and the natural beauty of her figure by straining and bowing her back over too low a table.

FIG. 14

FIG. 15

Wise economy.— "A penny saved is twopence earned" in physical as well as in commercial life. Many pennies of nervous energy may be saved in a day's work by using only the muscles necessary in the accomplishment of any task. For instance, in lifting, many persons use the back and arm muscles when only the latter are needed. Fig. 17 (a) shows the physically extravagant way of taking hold of a chair to lift it; Fig. 17 (c), the economical, easy, *becoming* way. In carrying a weight the body should be easily balanced, instead of being tipped backward from the hips, that the lower back muscles may not overwork as in Fig. 17 (a).

FIG. 16

The body's servants.— You remember the wise old saying, "Make your head save your heels"? Let us give you another: "Make your arms and legs save your back." Every woman facing a big day's work should remember that she has four sturdy servants to do her bidding. She should

direct them to render their rightful service, namely, to lift, to carry, to scrub, to wash, to walk, to stoop, to mount stairs, to sweep, to reach, to write, to sew. She should command them to save in every way possible the smaller, more essential and delicate muscles of the trunk, from labor unfitted for them.

Make the legs do the work in walking and running.— Women who have formed the habit of standing in a bent-back-burdened attitude exaggerate that bad position of the body when they walk, especially if there is a sense of hurry in the brain. Recall the mental picture of some neighbor hurrying about her work, in a sort of dogtrot gait, with body bent forward nearly one third from the upright, with head and shoulders quite in advance of the rest of the body, as if the legs could not, or would not, go fast enough for the impatient brain and body. Such is the "haste that makes waste." Such a position means straining and enfeebling the poor back, and it means interference with breathing, circulation, and digestion. It courts heaviness of movement, heaviness of spirit, and *oldness* of body. It announces that the woman is not master of her work; rather that her work masters and *drives* her. All must acknowledge that such a condition of things is wrong. A woman with much depending on her should be able *wisely to direct her body in her work*, and not allow her work to own her. When one is well-poised, and free and buoyant in bodily movement, one can walk rapidly, or even run, while doing one's work and suffer none of the exhaustive effects that always attend the spirit of hurry. An Arab proverb well puts it that "hurry is the devil." Shall we not keep ourselves serene and free from his malign influence?

(a) FIG. 17 (b) (c)

DAILY EXERCISES FOR ACQUIRING STRENGTH

One-minute exercises for rest from the strain of work and for keeping the body young

I. Stand erect, as nearly as possible in the position shown in Figs. 5 and 8. Raise the arms level with the shoulders, turn them so that the palm of the hand shall face directly forward. Stretch the arms well outward and at the same time push vigorously backward. Care should be

taken to keep the head well up; it is even better if the head inclines slightly backward. After pushing for a moment relax the arms and let them fall. Repeat the exercise two or three times.

II. Stand erect, the weight of the body being entirely on the right leg. Raise the left arm upward until it is close beside the ear; then, keeping the fingers pointing toward the ceiling, stretch upward as far as is easily possible. Hold this position of stretched muscles for a moment; then slightly relax the arm; again energize and stretch; then let the arm relax completely and drop by its own weight to the side. Without changing the weight of the body from the right leg, raise the right arm and stretch and relax as before. Repeat the entire exercise, standing with the weight on the left leg.

III. Stand well-poised over the balls of the feet. Lift the shoulders as high as possible. With intense energy slowly crowd the shoulders backward as far as possible and simultaneously bend somewhat forward from the hips — the head moving backward in opposition to the direction of the movement of the trunk. After holding this energized position for about half a minute, relax the muscles and allow the body to come to a buoyant, normal position. Repeat the exercise until a positive glow or warmth is felt between the shoulders.

IV. Sitting well back in the seat of the chair, shoulders resting against the back of the chair, greatly energize the lower part of the spine, curving it inward away from the chair back. The shoulders remain against the chair. Hold this energized position a moment or so, then relax the spine, being careful not to collapse at the waistline in front. Repeat the exercise several times.

V. Stand as shown in Fig. 8. Extend the arms well outward from the shoulders, keeping the palms of the hands facing forward. Rise on the balls of the feet; then simultaneously fill the lungs with fresh air and bring the forearms inward until the fingers touch the chest. Retain the breath a few seconds while the fingers lightly tap the entire surface of the chest. Then relax, come down on the whole of the feet, and exhale the breath. Again stretch, and repeat the exercise. Care should be taken to keep the body from inclining even slightly backward, as to do so brings strain on the lower back. In order to avoid such strain it is well to incline the body somewhat forward from the hips — not from the waistline. While patting the chest, the elbows should be raised very high so as to stretch all the side muscles. In ordinary daily occupations those muscles are often contracted for long periods. Such contraction interferes with digestion and circulation; it also tends to misshape the figure.

VI. This exercise is one especially beneficial in strengthening and freeing all the waist muscles. It also stimulates the action of the liver and of the stomach.

Sit erect with the back unsupported, as shown in Fig. 6 (b). Place the open hands at the waistline above the hips, the thumbs pointing backward and the fingers forward. First uplift the shoulders and the entire trunk as much as possible; then bend and stretch the trunk toward the right side. Hold this position of energized side-stretching for a moment, then come back to the position shown in Fig. 6 (b) and completely relax the side muscles. Rest a moment, again bend and stretch toward the right. Repeat the exercise by twice bending and stretching toward the left side. Care should be taken not to allow the body to collapse at the waistline in front when the side muscles are relaxed. At the beginning and during the moment of rest, the back should keep its double curve of strength and beauty.

Keep the body young in spite of years

There is another good to be gained by the practice of the one-minute exercises described above. In a marked degree they help to keep the body young — young in movement, in elasticity, in looks, and in feeling. No one who can work is too old to gain favorable results from the practice of simple, rejuvenating, restful exercises. The aging of the body is not a matter of years; it is rather a matter of condition. The way one habitually *uses* the body largely determines what its ultimate condition shall be. Oldness of body means setness of muscles as differing from the freedom of the child's muscles; it means stiffness of joints as differing from the flexibility of the child's joints; it means a stooped attitude as differing from the erect attitude of youth; it means heaviness of movement as differing from the lightness and buoyancy of youth. Setness of muscles, which is akin to the muscle-bound state sometimes found among athletes, can best be overcome by stretching and relaxing exercises, stretching the muscles in ways different from their customary use, and then completely relaxing them; stretch and relax, stretch and relax, three or four times in one or two minutes practice. A noticeable gain in freedom and spring in the movement of the muscles often results from even a few consecutive days of practice.

Mrs. Bishop, in her book entitled "Seventy Years Young," makes a distinction between organic old age and some of the prevalent old-age bugaboos. She makes years the worst hobgoblin of all and declares that years are only the arbitrary measurement of time, that they have terrorized victims into premature oldness of mind and body. Other old-age bugaboos are gray hair or lines on the face, and pessimistic theories concerning life. Robert Louis Stevenson gives good advice when he says, "Cling to your youth; it is an artist's stock in trade; do not give up that you are aging and you won't age." Shakespeare says, "With mirth and laughter let old wrinkles come." The person who moves about with diffi-

culty and says that he is getting old is inviting old age much faster than he who plays with boys and girls, keeps in touch with books and nature, and has not courted worry and fear of old age.

Gail Hamilton objected to the term "marry and settle down." It is easy after a day of fatigue to find it difficult to harness the team and drive out to social affairs; but just because such a tendency is becoming habitual one should pull himself together and go anyhow, whether or not it is easy to do so. Contact with other people, old and young, keeps the spirit young; while the habit of growing into fixed ways of staying at home will invite gray hair, wrinkles, and other indications of years. Young-looking men and women whose sons and daughters have grown up, are very attractive members of society. Very often others inquire of them, "How did you manage to keep so young?" Perhaps it was the very sympathy and companionship with their children that brought to the youthful-appearing parents that happy condition.

"The year's at the spring
And day's at the morn;
Morning's at seven;
The hill-side's dew-pearled;
The lark's on the wing;
The snail's on the thorn;
God's in his heaven —
All's right with the world."

SUGGESTIONS FOR STUDY AND CLUB DISCUSSION

1. Try at intervals the exercises suggested in this bulletin. While performing them, keep the weight forward on the balls of the feet, with the chest high, the hips back, and the chest and bust in advance of the abdomen. Exercises taken in improper positions are worse than none, since they bring strain on the organs and lead to unnatural attitudes.

2. Do not omit the rest and relaxing exercises of yawning, stretching, laughing. They all aid in digestion and prevent insomnia, nervous exhaustion, and nerve tension. They add to the normal, healthful condition of mind and body.

3. It would be well to use at each meeting the exercises described, appoint a leader, and, if possible, obtain the assistance of some one who has given special attention to the study of the exercises. Avoid an undue amount of muscular strain, as some of the exercises call into use muscles unused to work. Those muscles may be gradually strengthened, however, to serve in the work of the house and to save strain on the spine.

4. Discuss the application of the exercises outlined in this bulletin to attitudes taken in housekeeping.

5. Discuss methods and times for rest in the daily program of housework.

6. At the meeting devoted to the topic of saving strength, read from "Power through Repose" a chapter of interest on the subject. Discuss and apply the chapter.

7. Discuss the economic value of health.

8. Does sympathy put a premium on unnecessary disease?

9. Study the effect of physical education on people, from the earliest days.

10. Is the body as a whole as strong as its weakest part?

11. What seems to be the effect of carriage and physical attitudes on character?

12. What effect has our physical bearing on others?

13. How much can schools do to secure healthful attitudes in children?

14. If possible, introduce, from sculpture or pictures, the study of some strong ideal of manly or womanly strength — for example, of Apollo, Venus, or Diana.

15. Is enough done at home and at school to provide, for both boys and girls, games that effect healthy development?

16. Should the often excessive amount of exercise required in housework take the place of a brisk out-of-door walk?

17. Wherein does housework as specialized labor interfere with the healthful development of women?

18. Wherein can physical exercises counteract bad results of housework?

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SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

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COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

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SAVING STRENGTH

DISCUSSION PAPER

The object of the discussion paper is twofold: first, it gives an opportunity to the reader to classify her knowledge on the subject treated; second, it enables the reader to contribute interest and ideas profitable to the success of the Reading-Course. Many ideas helpful to other readers are thus put into the " exchange " system; one object in the course is to " pass on " needed information. No contributor's name will be used without her permission. Even though a member thinks that she has nothing valuable to contribute to the course, she will nevertheless afford much satisfaction to the Supervisor of the Cornell Reading-Course if she will answer questions and thus show her interest.

1. Do you find, when standing, that the weight of the body is borne on the balls of the feet or on the heels? Is there not more ease in the former posture?

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2. What is the difference between the exhaustion which comes from using the broom and that which follows an excursion or a party?

3. Is proper poise as attractive in the kitchen as in the drawing-room?

4. Have you established a balance with reference to work, exercise, and rest?

5. It is true that one lifts the head when he is hopeful. Will the lifting of the head make hopeful one who is despondent?

6. Will you not try to take a few minutes each day in which to relax mind and body, stretch the muscles, yawn, and take all the tension out of the body?

7. Do you get plenty of sleep? Many persons shorten life by taking insufficient sleep. Do you carry your troubles to bed, or do you go to bed intending to sleep?

8. " Laugh and the world laughs with you; weep and you weep alone." Do you laugh enough?

9. Can a person wear high-heeled shoes or tight clothing, and observe the laws of correct posture?

10. Nothing else that you can do will pay so large a dividend as will good care of the body. How much are you investing in such care?

11. Deep and heavy breathing drives away indigestion and is an enemy to disease generally. Do you take time to breathe deeply?

Name...............................

Address............................

Date..............................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

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CHOICE AND CARE OF UTENSILS

IDA S. HARRINGTON

For years we have accepted the saying, " It is a poor workman who finds fault with his tools." Now the world is beginning to recognize that discontent is a necessary element in improvement; that the man who studies his tools critically is the one who discovers ways to make them better or

FIG. 18.—*Various types of bails and handles, as described on page 19*

his use of them more effective, so that more and better work may be done with less effort.

Scientific management is enabling our great industrial plants to turn out more work and to pay higher wages for shorter hours. The watchword of this method is: " Get rid of poor tools, awkward methods, and unnecessary

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motions; pause for rest at such intervals as shall insure your being able to resume work at your best rate of speed."

Like opportunities for improvement are open to us in our kitchens. While waiting for the day when labor-saving machinery will be the rule instead of the exception, we can do much, by selection, arrangement, and care of our equipment, to make work easier and working hours shorter.

METHODS OF BUYING

None of us can afford to throw away our present outfit and buy a new one, but we can all afford to consider how we shall replace one article at a time as the opportunity comes. Two girls who were found busy with time-tables and maps said, when asked what they were doing, "Planning a trip to Europe." "Can you afford a trip to Europe?" asked their astonished friends. "Oh, no, we can't afford to go," was the cheerful answer, "but we can afford to plan." In the same way we can afford to plan before we can afford to replace. Indeed, we cannot afford not to plan. If we drift along until confronted with some immediate need, one of two things is sure to happen: either we take a hurried trip to some near-by town, go to a shop where kitchen utensils are temptingly displayed, and buy things that attract us as they stand in shining rows on the shelf; or some one comes to our door who is taking orders for the latest kitchen novelty or convenience. This person may have exactly what we want, just as the shopkeeper can satisfactorily supply our wants — if only they both know what our wants are; and that is something that neither a salesman who has never seen our kitchen, nor an acquaintance whose household problem is entirely different from ours, can decide for us.

Successful buying depends on knowing whether the work that a given utensil is best fitted to do is the work that we want done, and on choosing the utensil that will do that work satisfactorily for the longest time. Good buying is a duty which we owe to the community as well as to ourselves, since it is only by killing the demand for inferior things that we can protect inexperienced buyers, support conscientious manufacturers, and force unscrupulous manufacturers to raise their standard.

POINTS TO BE CONSIDERED IN CHOICE OF UTENSILS

In order to choose a utensil deserving its name, something fit for use, we must consider the following points:

Is the utensil genuine, or, to quote the salesman, "as advertised"? No other investment of money is so bitterly regretted as one that calls for the admission, "This was not worth buying at any price."

Is the utensil durable? A purchase of permanent equipment should add enough to the value of the working plant so that it need not be charged as an expense against the year of its purchase, but may be treated as an investment covering as many years as its usefulness continues.

Is the utensil convenient to handle? Convenience of handling depends on more than mere lack of weight. A heavy utensil, well balanced, with handle or bail set in just the right place and way, may be easier to use than a lighter one in which these points were not considered and which must be kept balanced by hand and wrist in order not to tip.

Shall we choose a utensil with a bail or one with a handle? The choice depends on the use to which the utensil is to be put, on its size, and on our available stove and storage space. For a utensil of moderate size, easily lifted with one hand, occupying little space in itself, and intended for use on top of the stove only, a fairly long handle is best: it does not get in the way of the cover or of the contents to be poured out; moreover, it may be so constructed as not to grow uncomfortably hot to the hand, either by being made hollow, or by being covered with wood as in the case of chafing dishes, coffee percolators, and the like. The wooden handle is better adapted, however, for use on oil, gas, or alcohol stoves than on coal or wood stoves, since with the former the area of heat does not reach the wood sufficiently to crack it. Birch is the most durable wood for the purpose, but the attractiveness of ebony or teakwood handles generally leads to the choice of some wood that can be given the ebony finish.

It is convenient, at times, to have a utensil that may be transferred at will from the top of the stove to the oven. For this purpose utensils are made with a very short handle or with two handles of the sugar-bowl type.

The half-circle metal bail, reaching, basket fashion, from one side of the utensil to the other, is best reserved for utensils so large in themselves as to require much stove and storage space and needing two hands to lift them. In this type of bail the wooden protector, hanging against the side of the kettle and very close to the fire, soon becomes cracked, breaks off, and makes necessary the use of holders; moreover, the bail is likely to get in the way when the cover of the utensil is being adjusted or when the contents are being poured out.

The choice of handles that do not grow uncomfortably hot is to be considered even in the matter of measuring cups. Tests with tin, aluminum, and glass measuring cups prove the glass to be as much more comfortable to handle as it is easier to clean than the other materials. Aluminum conducts heat too readily to make practical any utensil having a handle of the same material. Manufacturers take this into consideration in the making of saucepans, but have hitherto overlooked it in the making of measuring cups.

What kind of cover shall we choose? For long, slow cooking, when the purpose is to conserve heat, moisture, and flavor, a tight-fitting cover is necessary. For rapid boiling, when much steam is being produced, an easily removed cover is an essential safeguard.

Is the lip of the utensil in the right place? Lips of utensils should be on the side that is convenient, according as we are right-handed or left-handed. How many fulfill this requirement? Most utensils are designed to be held in the right hand while pouring one liquid into another. This necessitates either stirring with the left hand — a difficult operation for those who have been trained to the use of the right hand all their lives — or alternately pouring and stirring with the right hand, with the chance, whenever we set the saucepan down, of spilling a drop that will require wiping up later. A saucepan designed to be held in the left hand, leaving the right free for stirring, would, in the language of scientific management, "rid us of poor tools, awkward methods, and unnecessary motions."

FIG. 19.—*A conveniently constructed saucepan, allowing the use of either hand for stirring*

Is the utensil easy to clean? In order to insure ease of cleaning, a utensil should be made of one piece of metal with rounded sides, not with seams and corners. It should not have a rolled rim with a rough edge underneath. The joining of utensil and handle should not offer grooves or tunnels as gathering places for particles of grease, dust, and

soap. It is important that the inside rather than the outside of the utensil be smooth, polished, and consequently easy to clean. The opening should be wide enough to permit easy access to every part of the utensil. Our modern teakettles, made of smooth, nonabsorbent material, with an opening large enough to admit the whole hand, are sanitary and time-saving examples of this. They offer no excuse for leaving the teakettle unemptied and undried, with beads of slowly condensing steam roughening and rusting it.

Given a well-made utensil, much of the ease of cleaning depends on the preparatory care that we give before beginning to use it and on the care that we take of it after it is in use. This subject will be taken up with the different metals in turn.

Is the utensil of proper size and shape for the amount and kind of cooking to be done? The pan that makes an ideal omelet for three persons would produce a very unevenly cooked dish if used for an omelet for six. The breakfast cereal for a small family, if put into a large kettle in the fireless cooker, would soon lose its small stock of heat and remain raw. The latter contingency may be avoided in the following way: Have boiling water in the kettle that fits the cooker, set a smaller kettle containing the boiling cereal inside this, cover both closely, and pack the cooker in the usual way.

If a gas or an oil stove is used, the size of the bottom of the utensil greatly affects economy of fuel, time of cooking, and quality of the finished product. If the flame spreads beyond the edge of the utensil, heat is wasted. If the flame strikes only one point, there is danger of scorching food and utensil at that point; this leaves part of the product underdone unless constantly stirred into the area of heat. If utensils fail to fit the burner, a thin stove-lid of the proper size may be placed over the flame.

The time needed for evaporation, or boiling down, depends on the amount of surface exposed; hence, evaporation will go on more rapidly in a utensil that flares at the top than in one whose top and bottom are of the same size. The contents of a utensil made of material that is a good conductor of heat, such as aluminum, will boil down more rapidly than if put into an agate-ware utensil of the same size.

Is the utensil safe as a food receptacle? There must be no risk of forming poisonous compounds. As an illustration: We avoid the use of an iron utensil in canning and preserving, because we know that iron and fruit acids together form a harmful compound. But this caution should go a step further. If an enamel kettle has become chipped, so that the iron foundation and the acid can combine, it is best not to use it for cooking acid foods; even if the danger to health is slight, there remains the possible economic loss through impaired flavor or through scorching, as

well as the chance that chips of enamel may find their way into the food. (See " Care of enamel," page 1343.)

UTENSILS BEST ADAPTED TO THE DIFFERENT PROCESSES OF COOKERY

Baking

Cake.—Tin, if well cared for (see " Care of tin," page 1342), is the metal best adapted for cake making. It does not scorch, heats quickly to the point where the leavening agent in the cake becomes effective, and responds rapidly to necessary regulation of temperature during baking. The round tin with a tube in the center, known as an angel-cake tin, produces the most level and evenly baked cake, owing to the fact that the heat reaches

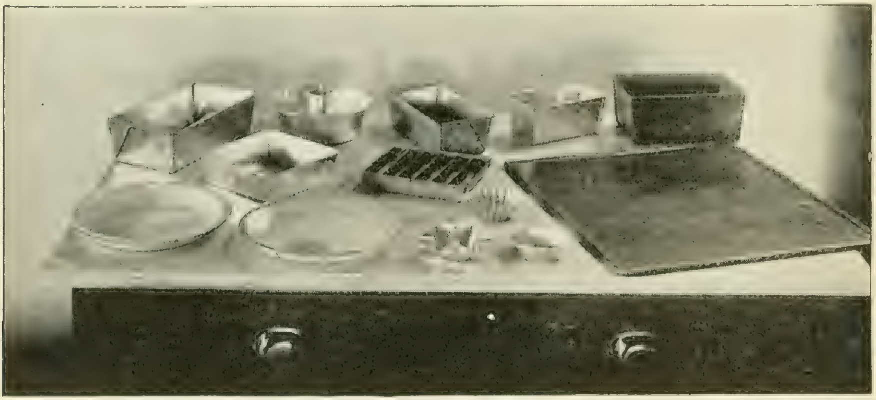

FIG. 20.—*Various shapes and wares adapted to the baking of bread, cake, and pastry*

the center of the cake as soon as any other part, and that the " pull " between metal and batter is more even at every point than in tins of other construction. A plain round tin, not too deep, gives the next best result; a square tin is next, while an oblong tin requires very careful regulation of heat in order to produce a well-baked cake.

Bread.— The choice of utensils for bread baking lies between tin and russia iron (a sheet iron treated by a process that originated in Russia, having a polished blue-black surface). Since bread requires a hotter oven than does cake, the russia iron pan should have first choice; it absorbs more heat than does tin, is less affected by high temperature, and is more durable.

Pie.— From experiments conducted by Miss Elizabeth Sprague, of the University of Chicago, in baking the lower crust of juicy pies. it was found that the best results were obtained from the use of granite-ware

plates, that old tin plates (see "Care of tin," page 1342) were next in order, while perforated and wire plates came third.

Cookies.— Cookies are best baked on russia iron sheets cut to fit the oven, with heavy tin sheets as second choice. The sheets are kept in better condition and produce more delicate results if, instead of being greased with butter or lard, they are warmed and rubbed very lightly with paraffin.

Meats

Roasting.— Roasts require a high temperature at the start in order to sear the surface; for this reason the best choice is a pan of iron or high-grade granite ware. An oval pan can be more carefully cleaned than one with sharp corners. There is less danger, therefore, if this shape is chosen, that particles of fat will adhere to the pan, grow rancid, and give an unpleasant odor to the utensil and a taint to the food.

Pot roasts.— The iron kettle with tight-fitting cover, called also the "Dutch oven," best supplies the steady heat that a pot roast needs. Although a casserole may be used, or a bean pot with waxed paper tied tightly over the top, in either of these there is more evaporation than in the iron kettle and the roast is therefore drier, although just as tender.

Meat stews.— Since in stews more liquid is added than in pot roasts the casserole may well be used, or a shallow aluminum or granite-ware stewpan with close-fitting cover, straight sides, and very short or loop-shaped handles. The long, slow cooking may thus be done either in the oven or on top of the stove. In brown stews, the meat is first sautéed in an iron pan in order to give the desired color and flavor.

Stewing fruits or vegetables

Aluminum, granite, or enamel ware is equally good for this purpose. A wide, shallow type of saucepan, with well-fitting cover, should be selected for fruits and for such vegetables as require to be cooked in a small amount of water; while a deep saucepan, without a cover, is best for the cooking of strong-juiced vegetables that need a large amount of water.

Sautéing

A rather heavy iron or steel frying-pan is best adapted for this purpose. In a thin pan, or in one of granite ware, the fat passes too soon from the temperature at which it forms the desired golden-brown crust on the food to be cooked, to the point where it begins to decompose and becomes irritating to the mucous membranes.

Frying

For frying in deep fat use an iron or steel frying kettle, which may either be bowl-shaped or have straight sides. The latter shape accommodates a greater number of articles at a time, and is more convenient for use with a wire frying basket since the basket fits it more readily. In using the bowl-shaped kettle, a long-handled skimmer may be found more convenient for removing the food. The kettle should be deep enough so that when it is two thirds full of fat the food to be cooked will be entirely immersed.

Candy making

Professional confectioners use a copper kettle connected with an apparatus that makes a partial vacuum in the kettle and allows the sugar to boil at a lower temperature than the ordinary boiling point, thus lessening the danger of scorching the sugar. For the home candy-maker, aluminum comes nearest to copper in its quality of conducting heat. Sirup boiled in an aluminum kettle rarely scorches, and the smooth surface makes it easy to keep the sides wiped free from sugar crystals as they form.

Jelly making

Enamel or granite ware (unless there is a defect in the enamel finish) is the best selection for jelly making, because of the ease with which it may be cleaned and the certainty that it will neither affect nor be affected by the acid of fruit juices.

CHOICE OF VARIOUS UTENSILS

Knives

It is impossible for any one but an expert to tell whether a knife has been hand-forged — that is, hammered by hand — or drop-forged by one heavy blow from a machine; whether it is "inlaid" by having two pieces of soft steel welded on either side of a hard steel inner piece, or whether the blade is of the same consistency throughout. Neither is it possible to tell whether the steel is of just the proper degree of hardness to continue to take a good edge after it has been in use. Since we know, however, that it is better economy in the end to buy a hand-forged knife, we should find out the name of some manufacturer who is known to make no other kind, and choose his product whenever possible. The most durable knife is one in which the steel extends, flat and unnarrowed, to the end of the handle, and is fastened to it by rivets of steel, copper, or brass. Strength is lost if the steel extends only half the length of the handle. In the cheapest setting, known as the "twang," the steel is narrowed to a point,

pushed into the handle, and fastened by adhesion. This is the kind of handle that is sure to come off at the most inconvenient time. Handles of beech or birch wood wear best. Rubber handles are unpractical because they shrink and swell.

Whatever type of handle is used, it is better to keep it out of the dish-water, holding it with one hand while washing the blade with the other. Steel knives are most easily polished with a cork and bath brick or some similar scouring material, after they have been washed and rinsed but not wiped. Rest the knife blade on a board, dip the moistened cork into powdered bath brick, and apply to the blade, rubbing until every stain has disappeared. Rinse the knives carefully and wipe dry.

The assortment of knives should include a bread knife, butcher's knife, vegetable knife, a knife with waved edge for cutting fresh bread and cake, and a palette knife, used by artists for cleaning palettes and adopted in every kitchen where cooking is classed among the fine arts. By means of the palette knife a bowl may be so completely freed from the batter that was mixed in it as to reduce dish washing to a minimum, while increasing the quantity of cake obtained to a maximum.

In order to preserve the temper of steel knives we must avoid the practice of heating the blade on top of the stove so as to facilitate cutting fresh bread or cake. Allowing hot water to run over the blade accomplishes the same purpose without injury to the knife, and this should always be done in cutting a frosted cake, in order not to mar the frosting.

Egg beaters

Different types of egg beaters are needed, according to the consistency desired in the beaten whites. For all-round use, the dover egg beater is a good choice because it works most quickly. It is operated by turning a wheel, without being lifted from the eggs to be beaten, and hence beats in comparatively little air and gives a fine, close texture. In choosing one, see that the cogs do not "interfere." (See "Iron and steel," page 1340.) The balloon-shaped egg whisk made of piano wire carries more air into the mixture, and the flat wire beater gives the airiest texture of all. Either of the latter types is preferable to the dover egg beater for angel cake, sponge cake, or meringues.

Spoons

Spoons of hard wood should be used whenever possible; they are lighter than metal ones, do not discolor the hand, make less noise, and do not scratch metal surfaces. For basting roasts, or whenever a specially strong spoon is needed, a tinned iron spoon is good. Enamel spoons are not practical, as they are likely to bend and crack the enamel.

Pastry and vegetable brushes

If brushes are used in connection with food — that is, for greasing pans or for brushing rolls or pastry with butter, egg, or milk — they must be of a kind that can be cleansed with boiling water. This is impossible if the bristles are glued in. The bristles should be strong and pliable (Russia or Chinese bristles are best) and should be bound to the handle with twine rather than with metal. A shaving brush of badger hair is really better adapted to the purpose than any brush specially designed.

Small wooden-backed brushes are indispensable for the proper cleaning of vegetables, for brushing grated lemon rind from the grater, and for many other purposes. Pyrography outfits may be put to good and practical use for burning on the backs of brushes the purpose for which they are to be used. In the absence of such an outfit, a small poker, heated red hot, will do just as well. A round pitcher- or bottle-brush, and a long wire-handled trap brush for the refrigerator, are sanitary necessities.

ARRANGEMENT OF UTENSILS

The best-selected utensils may fail in usefulness if arranged awkwardly. Although "stacking" is not the menace to kitchen utensils that it is to tableware, it calls for many unnecessary motions, especially if the utensil that we are seeking is the lowest one in the stack. Utensils in regular use are best hung on small brass hooks in the wall, each article having a separate hook. They should hang bottom side out, so as to protect the inside from dust, and should be within easy reach of the hand. If there is sufficient space for some definite system of arrangement — whereby, for instance, the largest utensils hang at the left and the utensils decrease in size as we go to the right — it will improve the appearance of our kitchen and enable us to reach mechanically the tool needed, instead of having to expend thought on its whereabouts. Whatever is kept in storage cupboards should be so arranged as to be:

1. Easy of access
2. Easy to keep count of
3. Easy to keep in order
4. Easy to note condition of

The average cupboard shelves are too far apart. They "sprawl." Shallow shelves that accommodate only one or two rows of utensils, easily seen and reached, will save many a frenzied search. Covers are conveniently stored behind ribs of wood nailed to available wall space or to a cupboard door. Arrangement according to size will again be found a great saving of time. A canvas or leather pocket, divided off in a way similar to a traveler's case or shoe-bag, is a convenient place for the cook's knives, each one slipping into its own division and being safer and easier to find than when in a kitchen drawer filled with miscellaneous articles.

PREPARING NEW UTENSILS FOR USE

Iron, tin, and enamel ware.— It is a general custom to prepare a new iron utensil for use, after thorough cleansing, by rubbing unsalted fat over it and baking the fat in. The same treatment is adapted to tin, for, while it destroys its shiny new appearance, it protects the tin from

FIG. 21.— *Narrow shelves as an aid in taking account of stock*

rust and increases its capacity for holding heat. Enamel ware, too, is said to be protected from cracking and chipping if it is well rubbed with fat before being used for the first time; the fat, however, cannot be baked in as with tin and iron, since it would not be absorbed but only burned fast to the glaze.

Glass.— Tumblers, jars, and lamp chimneys may be toughened by putting them into a kettle of cold water, bringing it gradually

to the boil, and after boiling a few minutes allowing it to gradually cool again.

Machinery.— Egg beaters, ice cream freezers, and any other utensil in which there is friction between two parts, should be carefully oiled before using, the wheels turned until the oil has reached every part, and all surplus oil wiped off before the utensil is used for food. The bearings should never be put in water, since they cannot be perfectly dried and therefore would become roughened and clogged by rust.

PROLONGING THE USEFULNESS OF UTENSILS

Repair kit

Much time and strength is consumed in trying to work with utensils in which some important part is displaced or lacking. Sending such atricles away to be repaired is expensive and often means doing without them just when they are most needed. A well-stocked repair kit is therefore a necessary part of the up-to-date kitchen. If we calculate the time, strength, and nervous force wasted in trying to use a teakettle lid with a loose knob, as against the time that it would take to tighten the nut which holds that knob if only the screw driver were close at hand; in hunting for the kitchen memorandum in a table drawer, when a nail and hammer would fasten it to the wall; in tugging at a warped pantry door when a few strokes of the plane would make it open and close easily; in slamming a door that will not close in any other way, for lack of a drop of oil on the catch; in having to discard a pet saucepan in the midst of preparing a company dinner, because a tiny hole makes it useless, when a drop of solder would cure the trouble; in trying to carve meat or cut bread with a dull knife, when the possession of a knife sharpener and the knowledge of how to use it would make the process a pleasure: we shall readily see what a change would be wrought by the presence of a tool chest containing hammer, screw driver, plane, pliers, oil can, saw, soldering outfit, knife sharpener, twine, shears, and such nails, tacks, screws, and hooks as are most often in demand.

Protection of utensils not in use

If the house is to be closed for a time, or if for any other reason the utensils are to be set aside, all metals should be protected from dampness by a coating of vaseline, paraffin, or unsalted fat of some kind.

MATERIALS AND THEIR CARE

Iron and steel

Of the metals used in our kitchens, iron in its three varieties — cast iron, wrought iron, and steel — is most common. Besides the utensils

commonly known as iron or steel, we have also those in which iron or steel form the foundation: tin, galvanized iron, enamel, and nickel-plated ware. The advantage of iron lies in its strength, durability, and power to hold high heat without melting. Cast iron is hard and brittle but withstands great pressure. It holds heat longer than does wrought iron. It is shaped by being cast in sand molds, and is used for griddles, frying kettles, and the wheels of egg beaters, cream whips, and other machinery. When defects occur in a kettle, or the wheels of the new egg beater refuse to act even after oiling, this may be because the mold was jarred, after the liquid iron was poured into it, allowing particles of sand to obstruct the flow of the metal. Thus a part of the pattern remains unfinished, just as when our batter does not reach every part of the waffle iron and the result is an imperfectly shaped product.

Wrought iron is being largely replaced by steel in the making of kitchen utensils since the lowered price of steel has made it available. Steel responds to many different forms of treatment and may be made either hard and brittle by being cooled suddenly, or soft and tough by being cooled gradually. By definite processes of heating and cooling it receives the quality known as " temper."

A good iron or steel utensil, well cared for, grows better and better the longer it is used. The two essentials are that it be kept dry and that it be kept smooth. The chief foe of iron is rust, caused by the action of moist air. Rust in itself has no harmful effect on food, but by roughening the utensil it makes that unsanitary. Moreover, unlike the films formed by the action of the air on zinc, tin, and aluminum, rust is not compact enough to act as a protective covering; once started, it proceeds rapidly to eat into the utensil that it has attacked.

Some cooks assert that an iron utensil should never be washed, but only thoroughly rubbed after use, in order that its surface may be protected by a constant coating of fat. However, if the air cannot attack the iron, it does attack the fat, causing decomposition which will taint the food cooked in such a utensil. The best way, therefore, to cleanse an iron utensil, is to boil in it a solution of washing soda, rinse it with boiling water, and see that it is thoroughly dry before being put away. As suggested in speaking of the protection of utensils when not in use, iron that is put away for a time should be protected with paraffin.

The question is often asked, " Should an omelet pan be used for any other purpose?" A pan cleansed after the manner suggested should be clean enough for any, and therefore for every, food, including an omelet. The cook who answered in self-defense, when accused of slowness in serving the breakfast griddle cakes, " But this griddle don't rightly bake but one cake," was merely betraying her methods of keeping that griddle unclean,

and would have found her labors greatly lightened if she had restored to it, by boiling it in soda solution, its original capacity for baking cakes.

Tin

If steel is coated with liquid tin we have what is known as tinware. Copper is sometimes used as a foundation for tin, but we do not generally think of it in speaking of tin utensils. Very few manufacturers now use wrought iron as a foundation for tin, but it is said that a light coating of tin on wrought iron will outwear a heavier coating of tin on steel. The manufacture of a new foundation known as " Toncan metal " is as yet a secret process.

The better grades of tin are not affected by the air, by weak acids such as vinegar or fruit juices, or by alkalies; they therefore effectually protect the steel foundation. Cheap grades, however, are not proof against the action of acids, and all grades are likely to change under the action of acids when hot. The quality of tin used may be determined by noting how a piece is marked, X being the cheapest and XXXX the best quality.

Tin utensils have the advantage of being light, inexpensive, and attractive in appearance when new. They are, moreover, good conductors of heat, so that food cooked in them becomes heated equally instead of being in danger of scorching by the overheating of one spot in the utensil before the rest reaches the boiling point. Though made more resistant to heat by the baking-in of fat, the low melting point of tin makes it unpractical where high heat is produced, as in frying, and makes unsafe the drying of tin by setting it on the stove.

Tin must be carefully protected from scratches, since every scratch, by marring the soft metal, exposes the steel foundation and is soon followed by a streak of rust. A tin utensil and a metal spoon should therefore never be used in combination, nor should a metal scraper be used for cleaning tin. Washing in hot soapsuds, boiling in a weak solution of washing soda, rubbing with whiting or one of the prepared cleaning powders, are the best ways of caring for tin. Always remember that it saves labor, as well as wear and tear, to fill a utensil with water as soon as the cooked food is removed, so that any deposit may be soaked off. Scouring tin to make it " look like new " is bad economy of time and strength, since the film that forms on tin acts as a protection and makes the utensil last longer.

Tin storage receptacles are good for keeping cookies and cake, but stone crocks are better for bread. The difference lies in the fact that the process of growing stale is a different one in each case. Cookies turn stale by absorbing moisture from outside; therefore they require that that moisture

be kept away. This the impervious tin cake-box does, especially if we add to the contents a few pieces of charcoal to absorb what little moisture may accumulate. Bread grows stale by a shifting of its own moisture from crumb to crust. A fresh loaf has a crisp crust and a soft crumb, while in a stale loaf the reverse is true. In a tin box, especially if it be unventilated, this moisture, held in the crust, soon makes a musty loaf. In a stone crock, which is porous, the moisture has a chance to escape, the crust becomes less soggy, and the flavor of the loaf is better maintained. In cake, where there is less difference in texture between the outside and the inside of the loaf, staleness consists in a gradual general loss of moisture. Cake is therefore better kept in tin, with the addition of a receptacle containing water, to be daily renewed. If cake and bread be stored in the same box, the cake will take up moisture (and incidentally a bready flavor) from the bread and remain moist longer, while the bread will dry faster than when stored by itself.

Granite and enamel ware

Granite and enamel ware are made by coating sheet iron or steel utensils with an enamel or glaze, a specially prepared glassy substance that is either sprinkled on the steel dry in the form of a powder, or mixed with water and floated on as a cream; after which it is melted by being put for just a moment into a glowing furnace. Two or three coats of enamel are applied successively. The quality of the enamel depends on the ingredients used and on the number of coats applied. Manufacturers test the strength of the enamel by a number of blows from a hammer of specified weight, and determine its power to withstand acid by testing it with acids of such strength as correspond to the strength of the common acids used in the household. The enamel used on cooking utensils differs from a pottery or porcelain glaze because it can (owing to its metal foundation) be subjected to an immediate degree of heat in firing which would cause pottery to crack.

Durability of granite and enamel ware depends no less on the quality of the steel or iron foundation than on the enamel finish. The foundation should be firm enough so that it will not bend nor dent easily, since this inevitably cracks the enamel. The tendency to bend makes enamel spoons unpractical. The foundation should be as light as is possible without sacrificing firmness and strength, since too heavy a foundation puts an undue strain on the finish.

There is a mistaken belief that if we avoid so-called "seconds" we are sure of getting a good article. As a matter of fact, it is only conscientious manufacturers who test their wares and set aside as "seconds" pieces that are not perfect in color or shape, or that show in the bend

of the utensil pinholes which the enamel failed to cover perfectly. If the perfect pieces, or "firsts," made by such a firm are beyond our purse, we are safer in buying their "seconds" than in choosing cheap "firsts," so-called. A poor quality of enamel soon wears off or loses its gloss and may even dissolve in the dishwater. The safest way is to inform ourselves of the standing of different manufacturers and be willing to pay for the assurance that an article is made "on honor." The best manufacturers agree that several thin coats of enamel of good quality are better and conduct heat better than does one thick coat.

Whatever the final verdict is to be concerning the harmfulness or harmlessness of inadvertently swallowing chips of enamel with our food, we hesitate to transfer enamel glaze from a place where it is needed to one where it is, to say the least, superfluous. Hence, proper care after buying is at least as important as proper care in selection of enamel ware. It is said that the ware is deteriorating in quality, but it is only fair to remember that when the ware first came into use certain precautions were generally observed: it was heated gradually, never put over a direct flame; it was cleaned by soaking and boiling, not by scraping; it was protected against sudden changes of temperature; and cooks were as careful not to drop it as if it had been any other variety of glass. Either familiarity has bred contempt, or the prevalence of bargain pieces, which are no bargains, has made us think that this ware does not repay us for careful handling.

Enamel ware is not designed to be proof against sulfuric acid, but if the emergency arises of having a deposit of greasy food so firmly burned on that nothing else will remove it we may have recourse to the following: Put a few drops of 25 per cent sulfuric acid into the saucepan, add hydrochloric acid of equal strength, and as soon as the acids begin to fume pour them off, wash the utensil and flush the drainpipe very thoroughly with cold water and soda so as to neutralize the acids, and then rinse with boiling water. The greatest care must also be taken that the acids are not spilled on hands or clothing. See Bulletin 100 of the Bureau of Chemistry, United States Department of Agriculture, for precautions regarding the use of sulfuric acid.

Galvanized iron

If iron, instead of being coated with tin or enamel, is dipped into melted zinc it is known as galvanized iron. The zinc coating makes iron rustproof, hence galvanized iron is the best material for garbage cans, refrigerator pans, and the like. Zinc by itself is used for table tops and for floor protectors under stoves, and is easily kept in good condition if given regular attention. Damp air coats zinc with a thin film of zinc oxide, which acts as a protection against further change. Any chemicals that brighten zinc eat into it, therefore it is safest to use only hot water and

mild soap for cleaning it. Stains may be removed by rubbing with kerosene or with a paste made of kerosene and baking soda, but the process should be followed by thorough rinsing with hot water. Zinc is affected by the action of salt at the seashore so that it does not last well. It is not safe for use in cooking utensils because it is affected by both acids and alkalies.

Nickel-plated ware

Another coating given to iron is melted nickel, the product being called nickel-plated ware. This takes on a high polish, does not rust, and is easily kept clean. It is therefore much used for coffeepots, chafing dishes, and other utensils designed for table use. Its durability makes it desirable for use in institutions, but its weight and cost bar it to a great extent from the private kitchen. Nickel-plated ware is kept in good condition by washing in hot soapsuds and rinsing in very hot water. It very rarely needs friction, but may be rubbed if necessary with a paste made of whiting and lard. Nickeloid is obtained by covering sheets of zinc with nickel, and is used for lining bathtubs and refrigerators. Nickel steel is a combination of steel and nickel used for parts of machinery requiring great strength.

Aluminum

Aluminum has come more and more into general use since the cost of producing it has ceased to bar it out. When commercial aluminum was first obtained from aluminum as it occurs in nature, the process was so complicated as to make the cost of the commercial article about twelve dollars a pound. Since the electrical process of obtaining it was perfected, the cost has dropped to about thirty cents a pound. Comparing the weight of the finished article with its cost, we realize that the price which we pay cannot all be charged to the amount of material used or to the skill in manufacture.

The advantage of aluminum utensils is that they are light, well made, easily cleaned, and excellent conductors of heat. Milk, rice, sugar, and other easily scorched foods are comparatively safe in aluminum. Aluminum has been suspected of forming poisonous compounds with the foods cooked in it. If this proves to be so, then aluminum must share the fate of the copper of our grandmothers. It would seem, however, that the only reason for the suspicion has been that the appearance of aluminum is very easily affected. It may be said to differ from some of the other metals in this regard in the same way that the little boy who is always being caught in mischief differs from the one who may be just as guilty but manages every time to escape detection.

Aluminum does not withstand a high temperature. If heated over a gas or oil stove, the flame should not be turned on full; if over wood or

coal, the stove lid should be left on. Many complaints of the warping of aluminum have been due to not using this precaution. An aluminum utensil may be injured by allowing some foods to remain in it for any length of time. A story is told of how a family, summoned hastily away from home, left oatmeal standing in an aluminum dish. When they returned several days later, the dish was full of holes. The oatmeal had soured with the heat, while some of the wild yeast plants always present in the air had added themselves to the compound and begun to work, and in doing so had riddled the utensil.

The outside of aluminum utensils can be kept bright by the use of any kind of metal polish that is not gritty. The inside surface is easily darkened by water containing alkalies or iron. This thin dark coating is easily removed by the use of whiting or any of the cleaning powders that do not contain free alkali. If food or grease is burned into the surface, it can usually be soaked loose by keeping hot water in the utensil for several hours; after which it may be removed by scraping with a wooden spoon. If this fails, the utensil may be scoured with fine sand or powdered emery or fine steel wool. If the utensil has been allowed to get into very bad condition, one may have to use a solution of four tablespoonfuls of oxalic acid crystals to a gallon of water in order to loosen the carbonized fat; this solution to be left cold in the utensil overnight, or boiled in it for not more than five minutes. Before using after this treatment, the utensil should be washed carefully with hot water and soap. As oxalic acid is very poisonous, every precaution should be taken. It is far better, if the emergency requiring its use arises, to buy just enough instead of trying to keep any on hand. The mild acid of sour milk or tart apples, boiled in aluminum, will brighten it very effectually.

Copper

Copper is, next to silver, the best metallic conductor of heat. Its use in the household is limited because of its expense and weight, the danger from its use when not carefully cleaned, and the labor involved in keeping it in good condition. This last point — which, in the mind of the housewife, condemns it utterly — is made an argument in its favor in many large establishments, the theory being that one glance at a copper utensil will reveal whether or not it is being properly cared for, thus economizing on the time of a high-salaried inspector. Its durability also makes it desirable in public kitchens, where the time lost by having a utensil give out is an item to be considered.

Vegetables, acid fruits, or preserves, if cooked in copper, should not be left for a moment after they are done. Copper and acid, when exposed to the air, form verdigris, which we all know to be very poisonous. The

green coloring that forms when copper is exposed to moist air alone is not verdigris, although it is often so called. Copper cooking utensils should be washed with washing soda in order to remove all grease; stains should be removed with salt and vinegar, or with oxalic acid; and the utensil should then be thoroughly rinsed. Unless the acid used for cleaning is thoroughly rinsed off, copper will tarnish the more quickly because of its use. The acid may be further counteracted by rubbing with whiting. If not stained, copper is best brightened by rubbing with rottenstone or tripoli and sweet oil. Rottenstone and tripoli are varieties of an impure decayed limestone.

Silver

Silver is of all metals the best conductor of heat, but its costliness bars it out as a cooking utensil. Silver has to be combined with copper in order to make a compound hard enough for use. Plated silver is copper with a thin coating of silver applied by electricity. Silver does not tarnish, that is, grow dark, unless it comes in contact with sulfur. "Oxidized" silver has been treated with sulfur — in other words, purposely tarnished. If our silver discolors badly, there is an escape of sulfur either from our fires or from our lights; or the silver has been stored near rubber or has come in contact with a rubber plate-scraper; or it has been wrapped in paper or cloth bleached with sulfur; or it has been used in eating eggs. Or, possibly, some one has been handling the silver who has previously assisted in spraying the orchard with lime-sulfur; in which case he would find it very difficult, in one washing, to free his hands from sulfur sufficiently so that they would not affect silver. The rule against handling silver with the bare hand in wiping it or in setting the table is a labor-saving one, since human perspiration also contains sulfur and a warm, moist hand is sure to leave its mark.

Cloudiness of silver, with no change of color, may be due to imperfect rinsing or to that film of dust and moisture present in any room not perfectly ventilated where human beings work and breathe. Plenty of hot soapsuds, careful rinsing and wiping, will remove this film without the need of much rubbing. To remove tarnish the use of silver polish, or of something that replaces it, is necessary. Silver is successfully cleaned by boiling it for five minutes in a new or bright aluminum or tin dish, in a solution made of one tablespoonful of baking soda and one tablespoonful of salt to every quart of water. The aluminum utensil must be kept scoured or it will not be effective. Most silver polishes have whiting for a foundation, made into a paste with either water, soap and water, alcohol, or, for solid silver, ammonia. The paste is rubbed in, the liquid allowed to evaporate, and the powder rubbed off with tissue paper or with a soft

cloth. Silver should always be scalded after polishing as well as after washing; the utensil that comes into direct contact with the mouth cannot be too carefully looked after.

Pottery

Porcelain, stoneware, and earthenware all have clay for a foundation, but differ in appearance and quality according to the fineness of the clay used, the kind of glaze applied, and the length of time taken for firing. Only long firing at high temperature produces a hard, impervious ware. Some very attractive pieces of porcelain are so soft that if a broken piece were dipped in ink it would absorb the fluid almost as blotting paper

FIG. 22.—*Casseroles and meat plank, utensils in which foods may be both cooked and served. Grater, grater-brush, palette knives, meat fork*

would. If one were buying a quantity of china and had any doubt of its quality, it would pay to sacrifice a piece in order to make this ink test. Good stoneware can hardly be distinguished at first glance from porcelain, but its glaze is of a kind that easily becomes scratched or covered with fine cracks. This makes it unattractive for tableware. Earthenware is made of the cheapest grades of clay, and its glaze — which is produced by throwing common salt into the furnace during the firing of the ware — is easily chipped, exposing the very porous ware underneath. For this reason white stoneware mixing-bowls are in the end cheaper than yellow earthenware.

Fireproof ware is made of clay which contains little or no iron, and which therefore withstands fire. Utensils of this kind are sometimes left unglazed, but more often they are covered with a glaze that is fired at a sufficiently high temperature to make a hard, smooth, glassy surface, which is proof alike against high heat and the effect of acids. Fireproof earthenware

has long been represented in our kitchens in the shape of the Boston bean pot. We now have, in addition, a large variety of "casserole dishes." "Casserole," as used in the cookbooks, means literally something hidden, such as a casserole of meat and rice, wherein the meat is hidden under a layer of rice. The name has been adopted for the closely covered earthenware dishes in which food may be both cooked and served. The economy of long, slow cooking, whereby the cheaper cuts of meat are made digestible and palatable, is being given more and more consideration. Utensils that are equally useful for cooking and serving save time and strength in addition.

If stoneware, earthenware, or china dishes are to be allowed, after washing, to dry without wiping, it is important that the rinsing water be very hot and very clean. Imperfectly rinsed dishes, dried without wiping, become coated with a thin film which in time spoils the glaze. Many dishes are returned to the potteries in this condition for the purpose of being reglazed and refired.

Glass

Glass is made by melting together sand, a lead or lime compound, and a compound of soda or potash. The quality depends very much on the purity of the raw material. The greenish color of the glass seen in cheap windows, and so widely used in making preserve jars and bottles, is due to the presence of iron in the sand used in manufacture. Potash glass is harder to melt than soda glass and is therefore chosen for making receptacles for boiling liquids in chemical laboratories.

Glass is being more and more used in our kitchens, for measuring cups, rolling-pins, storage jars for cereals, milk bottles, jelly and preserve glasses. The glass door for our ovens and glass tops for our percolators not only save time and motions, but also satisfy the general desire to see things actually happening. Glass of good quality is durable if handled carefully. Breakage occurs usually because we overlooked a crack somewhere and handled the utensil as if it were entirely sound. A utensil is no stronger than its weakest part. Another way in which glass is broken is by pressure from the dishcloth or dish mop when washing the inside. Try this method for delicate glasses or cups: Have enough water in the dishpan so that when the glass or cup is turned upside down it will be entirely full of water; now lift the glass quickly, still keeping it upside down and being careful not to tip it. It will remain full of water until it reaches the surface, when the rushing in of air will force the water out so suddenly that it will carry all food particles with it. This is an excellent method for washing sherbet and lemonade glasses, as well as for freeing of coffee grounds the strainer of a coffee percolator.

Soapstone

Soapstone, a variety of talc, grayish green or brown in color, is used for kitchen sinks and for cake griddles; but unless it is of the best quality and its pores are kept well filled with oil, it is too absorbent to be sanitary and is better replaced by iron.

Marble

Marble, a compact limestone, is very absorbent in its natural state, but by powerful friction its pores are filled with the fine particles rubbed off, and a glassy surface is produced which is nonabsorbent. This surface is, however, easily destroyed by scratching or by the action of acids. This must be taken into consideration if marble is chosen for a table top or for pastry work. If lemon or orange juice has been spilled on marble, the stain may be removed in one of the following ways: Scour with powdered emery and water first, then substitute powdered pumice stone and water, then the still finer tripoli, and finally whiting; or apply gum arabic, and remove it and the stain together by mechanical action; or make a paste of fuller's earth, pipe clay, or french chalk, and soap. Cover the stained place and let it dry out. Wash off with water, or pull the dry part off.

Wood

Wood, if unprotected by paint, varnish, filler, or covering, is little used in an up-to-date kitchen. Tables are covered with zinc or oilcloth and the food chopper replaces the old-time chopping bowl. In the case of an extra table which for some reason is to be left uncovered, or of a bread board, the best wood to choose is maple. In caring for it we have three problems to consider: it may become dented, rough, or darkened. To remove dents, put a wet pad of several thicknesses of cheesecloth or muslin on the dent and cover it with a hot iron; the steam will raise the fibers of the wood much as it raises the pile of velvet. To smooth away a rough place, rub, with the grain of the wood, with steel wool — a substance resembling excelsior in appearance but grayish in color and made of fine particles of steel. This may be obtained at any hardware store. To restore the color of the wood if darkened, use steel wool and weak hydrochloric acid. Fine sand is better than soap for scrubbing wood, because the alkali in soap combines with wood to form a dark stain which is really a kind of ink. Scrubbing should be done with a circular motion of the arm, for better cleaning of the wood and less exertion to the worker, but rinsing and drying should always be with the grain, in order that the fibers may be left flat.

Steak planks.— With the passing of wood for other uses many persons are just discovering that meat cooked on a well-seasoned oak plank has a flavor unlike any other, and comes near to filling the desire for "some new animal" which every household voices from time to time. A home carpenter may earn much gratitude by making one of these planks. It should be oval, one inch to one and one half inch thick, about eighteen inches long by twelve inches wide, with a depression at one end for holding the juices and with grooves leading toward the depression. The meat or fish, when done, is usually surrounded by mashed potato, put back into the oven until the potato is browned, and served on the plank. It is really a development of the board set easel-fashion in front of the camp fire for cooking fish or corn bread. As sold in the shops the planks are furnished with trays on which to bring them to the table, but any oval tray fulfills the same purpose; in fact, the plank may be made to fit a tray already in use. To make the planks nonabsorbent, after thoroughly cleansing them rub in all the oil (suitable for coming in contact with food) that the wood will take up.

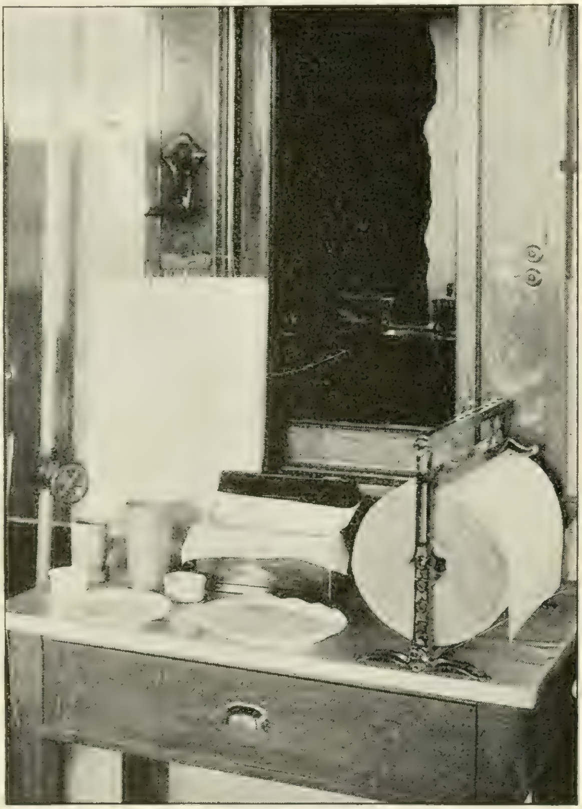

FIG. 23.—*Paper utensils*

Skewers and toothpicks.— A list of utensils would not be complete without the mention of wooden skewers and toothpicks. For testing cake, wooden toothpicks are as good as, and much cleaner than, broom straws. Skewers are helpful in cleaning corners, or, covered with several thicknesses of cheesecloth, in keeping free from crystals the sides of the saucepan in which sugar is being boiled down.

Paper

Heavy, absorbent brown paper, on a roller, such as is used in meat markets, is a great kitchen help. In breading cutlets or making croquettes, for example, cover the table or the rolling board with paper and empty the bread crumbs on it. After the croquettes are breaded, remove the crumbs and let the same paper do duty for draining the croquettes when they are fried. It may afterwards be folded up and burned, or given as a titbit to the chickens, in either case saving the washing of a mixture of egg and bread crumbs from the rolling board.

Waxed paper, so essential for the putting up of lunches, lining cake tins, and covering food in the refrigerator, may also be obtained on rollers. Covered paper pails, lined with waxed paper, are useful for storing dry left-overs. Paper cups, plates, and napkins are a welcome help in the picnic lunch or the grange supper. The plates may be bought with linings, or "insets," to be replaced by clean ones for a second course. Folding paper cups should be a part of every school lunch or traveler's outfit.

Fiber pails, washbowls, and tubs are useful because of their lightness, and with careful handling they will last a long time. Breaks in the finish may be mended by filling with a little putty, covering this with a piece of stout cotton cloth, and holding the whole together with oil paint to match the finish.

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SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL II. No. 27 — ITHACA, N. Y. NOVEMBER 1, 1912 — FARM HOUSE SERIES No. 5

CHOICE AND CARE OF UTENSILS

DISCUSSION PAPER

The object of the discussion paper is twofold: first, it gives an opportunity to the reader to classify her knowledge on the subject treated; second, it enables the reader to contribute interest and ideas profitable to the success of the Reading-Course. Many ideas helpful to other readers are thus put into the "exchange" system; one object in the course is to "pass on" needed information. No contributor's name will be used without her permission. Even though a member thinks that she has nothing valuable to contribute to the course, she will nevertheless afford much satisfaction to the Supervisor of the Reading-Course if she will answer questions and thus show her interest.

1. Wherein is this lesson a help to you in the choice and care of utensils?

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

2. If you could have your kitchen utensils made to order, what improvements would you suggest?

3. What, in your experience, has been the most satisfactory ware for the baking of bread? of pie? of cake?

4. Have you tried casserole cooking? Do you find that it saves work?

5. Have you a tool chest in or near your kitchen? Will you name some tools that would be a desirable addition to your kitchen equipment?

6. Have you had any experience with the chipping of enamel ware? with discoloration of aluminum? with warping of aluminum? What remedies have you applied?

7. What do you consider the most satisfactory table top for kitchen use?

Name.................................

Address.................................

Date.................................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 29 — ITHACA, N. Y. DECEMBER 1, 1912 — FOOD SERIES No. 7

COST OF FOOD

FLORA ROSE

All around us we hear discussions of the present high cost of living; and the situation is grave enough to make us ponder it. Those who are students of economics assure us that prices will never again be low. The housekeeper's problem, therefore, is not to lower prices, but to study values so that each expenditure shall be made wisely.

ECONOMY IN PURCHASING

How may the grocery bills be reduced? The housekeeper whose business it has always been to make one dollar do the work of two, is aghast at this growing need of making it stretch so as to do the work of three. She may still look longingly at a tempting array of foods, but she is learning to say, "I can't afford it." Being human, she occasionally succumbs and does afford it in spite of good resolutions.

The "can't-afford-it" method of spending the family income is much better than no method at all; but real economy must be based on something more definite than the statement that there is not enough money to go around. It is undoubtedly necessary for the housekeeper to have strength to resist a purchase; but in order to go a step farther on the path of economy, she must have the knowledge that will enable her to put to herself the question, "Can I afford not to have it?" Every purchase, whether of food or of other supplies, should be submitted to some such test as this: (1) What is its purpose? (2) Is the article suitable for the purpose for which it is intended? (3) Is the purchase necessary in order to maintain or increase efficiency? (4) Does the usefulness of the article warrant its cost? (5) Is there anything else which for the same cost

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would give as good results? (6) Am I qualified to judge this article on its real merits?

The housekeeper must be more than a critical purchaser, she must be an analytical one. If she finds herself not qualified to make a certain purchase, she must, for once, do the best she can and then hasten to qualify.

THE REAL COST OF FOOD

The price paid for food must not be measured solely in terms of dollars and cents. Food purchased at small cost is cheap only when it is capable of maintaining the body in a high state of efficiency. If it fails in this, it is an extravagance far more subtle than the open, careless spending of money, for it is hard to trace increased doctors' bills, lessened power of accomplishing work, and early deterioration to an extravagantly cheap dietary.

This does not mean that food procured at low cost may not furnish an efficient dietary, nor that the purchase of expensive foods will insure right nutrition. It merely indicates that the money value of a food must not be the only determining factor in the inclusion of that food in the dietary.

If, then, the real cost of food is to be determined, the food must be put in the witness box and questioned as has been previously suggested. The housekeeper must learn what is the purpose of each food, in what way the food meets the body's needs, whether it is necessary to the welfare of the family, whether some other food could supply the same needs at a lower money cost. She must know both food values and human needs, and must be able to interpret one in terms of the other and to keep expenditures within the family income. It takes no mean intelligence and no little thought to provide an efficient dietary on a small income. Wisdom and common sense in the choice of foods for the family table have a double commercial value, in that they not only reduce the cost of living but also diminish the risk of lowered efficiency through wrong nutrition.

KNOWLEDGE NECESSARY TO INSURE PROPER PLANNING OF THE DIETARY

The ability to purchase foods wisely and well, to plan meals that shall be at once gratifying, satisfying, and fundamentally right, does not come by instinct nor is it to be acquired in a moment. Like any good piece of work, it requires time and study, thought and effort, to make it successful. The following outline of body needs and food functions is intended to indicate only in the briefest way some of the food problems that the housekeeper faces, and to show one method of judging the value of the food that is so important a part of family welfare. Without a little of this knowledge the housekeeper is really groping blindly.

The human machine

The human body is a living machine whose purpose it is to transform one kind of energy into another kind. The main part of the food that goes into the body machine each day should be of a sort that will yield energy. One of our needs is to find food which will supply that energy at the least cost and in a form which will give the best service. It is the same old problem that we have had before us in dealing with the cost of running the cookstove, furnace, or steam engine; but now the problem has its human application.

Best fuels for the body.— The substances which are cheapest and which give best service to the body as fuels — that is, as energy yielders — are the sugars, starches, and fats. Therefore, foods such as cereals or cereal products, legumes, potatoes, butter, fat meats, oils, must occupy a prominent place in the family dietary.

Body-building substances.— The human machine, like other machines, requires various materials for repairing it and building it up. The main building material of the living tissue of the body is the substance known as protein. Lean meat, white of egg, casein of milk, gluten of wheat, are all typical protein substances. Other materials are also required for body building and body welfare, and must not be neglected when the cost of food and its uses in the body are being considered. Bones, muscles, and nerves all need lime and phosphorus, red blood must be supplied with iron. Sodium, chlorin, magnesium, potassium, and a number of other substances of less defined use, are all necessary not only to the welfare of the body but to its ability to continue its existence. Their cost must also be reckoned in the purchase of food.

How foods may be compared as to real cost

If, then, the cost of food is to be judged, the specific food needs of the body must first be determined, then the various foods must be compared as to their ability to satisfy each of those needs.

The trained housekeeper will soon begin to ask herself which foods are cheapest as a source of energy, and which as a source of protein, iron, lime, or some one of the other substances needed by the body. The cost per pound will finally take its right place in her mind as something with which to reckon, but not as something by which to be overwhelmed. She will find that a food which is a decidedly expensive source of energy may on analysis prove an indispensable source of iron or of lime; that a food which is an expensive source of protein may be exceedingly cheap as a source of energy; or that a food which seems expensive as a source of both protein and energy is still a cheap food because of its supply of iron or lime or phosphorus. And so she will test each food and make her final choice on an intelligent basis.

The unit of measure for determining the energy requirement of the body.— Just as there must be some unit of measure for weight, for distance, for temperature, for cubical contents, for money, so there must be some unit of measure for energy or heat. The pound, the yard, the square inch, the degree, the dollar, are so familiar to us that we never question what they mean or how they were obtained. We have always been accustomed to seeing solids weighed and distances measured. We have learned to translate values in terms of dollars and cents. Our experience even gives us some fairly accurate idea of what is meant when we say that the thermometer stands at 32° or 100° F. The unit of measure for energy, or heat, which is called a "calorie," has not been in the past a part of our education; but it is to be important in the future if we are to provide best conditions for human welfare.

In any large factory where many engines are in use and furnaces must be kept going night and day, the energy value of fuel consumed is of great importance. Just as the grocer must know how many pounds or bushels or tons are being delivered to him, so the manufacturer must know how much energy — that is, how many heat units, or calories — the fuel that he is buying is capable of giving him. He, like the grocer, cannot afford to pay for short measure.

Daily food requirement.— The human body, like the machine, is a spender of energy. We must learn what amount of energy — which we measure by calories, or heat units — the body spends every day under different conditions of age and activity; and we must determine the amount of energy that the various common foods are capable of giving to the body, and then compare the various foods in terms of the calories that they are capable of yielding. We must find out how much building material, in the form of protein, the body needs each day and how much and at what cost our various foods can supply protein. We must find out how much lime, iron, phosphorus, magnesium, and potassium are needed, and how the common foods compare as sources of those substances. Finally, we must stop and consider all the data accumulated and learn whether the energy, protein, calcium, and other material furnished by one food, even at a lower cost than by another, are of as good a type and as available to the body as those supplied by that other. Then, and only then, have we a real basis for comparing the cost of foods. Then only do we begin to develop a philosophy of the right and economical nutrition of those for whom we must care.

Table for estimating food requirements.— The following table, like any table of the kind, is only a guide, or indication, as to the food requirements of the body as these are understood to-day. While it cannot be followed inflexibly, it should at least serve a useful purpose in giving an idea of the amounts of some of the typical food substances needed, and will form a basis for comparing the values of various foods in supplying those needs.

TABLE 1. A METHOD OF ESTIMATING THE FOOD REQUIREMENT OF YOUNG TO MIDDLE-AGED MEN AND WOMEN

Energy requirement	Protein requirement		Partial mineral requirement				
	Protein required for each pound body weight		Total average daily mineral requirement: Calcium, phosphorus, iron, magnesium, potassium				
Energy required for each pound body weight	Amount favored by those believing in low-protein diet (ounces)	Amount favored by those believing in high-protein diet (ounces)	Calcium calculated as Lime (CaO) (ounces)	Phosphorus calculated as Phosphoric acid (P_2O_5) (ounces)	Iron calculated as Iron (Fe) (ounces)	Magnesium calculated as Magnesia (MgO) (ounces)	Potassium calculated as Potash (K_2O) (ounces)
For a person:							
1. At complete rest, 14 to 16 calories	.0118 to .0128	.0153 to .018	.0333 to .05	.0916 to .1	.0005 to .0006	Not determined	
2. With light work, 16 to 18 calories	.0128 to .0147	.018 to .0206	.....	.....	.....	.....	
3. With moderate work, 18 to 20 calories	.0147 to .0165	.0206 to .023	.....	.....	.....	.....	
4. With hard work, 20 to 23 calories	.0165 to .0185	.023 to .026	.....	.....	.....	.....	

TABLE 1 (*continued*)

A man of average weight — about 154 pounds — would require in one day a total of

Energy (In terms of calories, or heat units)	Protein		Calcium calculated as Lime (CaO) (ounces)	Phosphorus calculated as Phosphoric acid (P_2O_5) (ounces)	Iron calculated as Iron (Fe) (ounces)	Magnesium calculated as Magnesia (MgO) (ounces)	Potassium calculated as Potash (K_2O) (ounces)
	For low-protein diet (ounces)	For high-protein diet (ounces)					
1. At complete rest, 2,100 to 2,450 calories.......	1.83 to 2	2.33 to 2.83	.0333 to .05	.0916 to .1	.0005 to .0006	Not determined	
2. With light work, 2,450 to 2,800 calories.......	2 to 2.26	2.83 to 3.16	....	....	....	....	....
3. With moderate work, 2,800 to 3,150 calories..	2.26 to 2.53	3.16 to 3.50	....	....	....	....	....
4. With hard work, 3,150 to 3,500 calories.......	2.53 to 2.83	3.50 to 4.03	....	....	....	....	....

Table for comparing the cost of various foods.— In comparing the cost of energy as supplied by various foods, two points of view have been adopted: first, the cost of sufficient food to furnish 3,000 calories, the amount of energy required daily by the average man at moderate muscular work; second, the amount of energy that various foods can furnish for ten cents. The price assumed for some of the foods is necessarily arbitrary, since prices will vary from day to day and from place to place. In comparing the cost of the various nutrients supplied by foods, the ten-cent basis has been used. The following table (pages 1364-1365) should prove of great value to the housekeeper desiring to feed her family in a progressive way. While it has not been possible to include a wide variety of foods, an effort has been made to choose those that are typical. The housekeeper can thus group, under the types given, foods that are not included.

One soon learns from such a study of foods that the really cheap sources of energy are cereals. Here also, however, a study of our table will show us marked differences among various types. It is very interesting to compare the energy cost of two cereal foods such as oatmeal or corn meal, with a ready-to-eat cereal food such as shredded wheat, and find that shredded wheat is really expensive as a source of energy — as expensive, in fact, as whole milk at six cents a quart — and is more expensive than whole milk at six cents a quart as a source of protein. From the energy and protein standpoint, corn meal is an exceedingly cheap food; but as we look further we find that it is an expensive source of lime, iron, and potassium. Whole milk, even at ten cents a quart, is a cheap source of lime, while skimmed milk or buttermilk is very cheap as a source of lime and phosphorus. From a study of the table, eggs seem to be a comparatively expensive form of most nutrients, except iron. Here, however, is where even further knowledge of foods is necessary; for, while eggs are expensive, the protein, iron, and phosphorus contained in them are of a kind that is considered to be unusually available to the body, whereas the iron and phosphorus in such a food as meat are not believed to be so completely used by the body.

Comparative cost of edible material in foods.— Many persons do not realize the importance of considering the proportion of edible material when purchasing foods. This is particularly true in the case of meat. Rump, round, beef loaf, a piece of neck or chuck, is just as nutritious as porterhouse or tenderloin and may be made as palatable. Not only may the cheaper cuts of meat be as nutritious and as palatable as the more expensive ones, but they may often be found to be less wasteful as well. A cheap piece of meat may not prove cheap in the end, however, if we pay for bone instead of for edible material.

TABLE 2. METHOD OF COMPARING THE COST OF SOME COMMON FOODS AS SOURCES OF (A) ENERGY, (B) PROTEIN, (C) CALCIUM, IRON, PHOSPHORUS, MAGNESIUM, AND POTASSIUM

Food	Cost		Amount to be purchased for ten cents						
	Per pound	Per 3,000 calories	Calories	Protein (ounces)	Calcium calculated as Lime (CaO) (ounces)	Iron calculated as Iron (Fe) (ounces)	Phosphorus calculated as Phosphoric acid (P_2O_5) (ounces)	Magnesium calculated as Magnesia (MgO) (ounces)	Potassium calculated as Potash (K_2O) (ounces)
Oatmeal	$0.06	$0.099	3,018	4.27	.03	.009	.217	.052	.113
Corn meal	.03	.055	5,400	4.90	.0072	.0005	.144	.0648	.09
Shredded wheat	.15	.27	1,106	1.10	Not determined				
Bread (white)	.06	.15	1,998	2.41	.0073	.00019	.0499	.0073	.0266
Bread (graham)	.06	.15	1,981	2.36	.0125	.00085	.1253	......	....
Rice	.10	.185	1,620	1.28	.0016	.00016	.0307	.0070	.0124
Potatoes	.02	.198	1,510	1.44	.0095	.00075	.0835	.0211	.3170
Beans (dried)	.10	.19	1,565	3.60	.0328	.0010	.1700	.0375	.2091
Beans (lima)	.10	.19	1,586	2.89	.0148	.0010	.1157	.0459	.3119
Almonds	.80	.816	367	.41	.0056	.00003	.0161	.0064	.0036
Walnuts	.40	.377	795	.73	.0039	.00007	.0286	.0087	.0161
Milk (.06)	.03	.286	1,046	1.40	.0833	.00011	.1056	.0094	.0847
Milk (.08)	.04	.38	785	1.32	.0632	.00008	.0792	.0070	.0635
Milk (.10)	.05	.477	628	1.05	.0500	.00007	.0634	.0056	.5086
Milk (skimmed or butter)	.02	.359	835	2.40	.1155	......	.1697	.0200	.1377
Cheese (full cream)	.20	.317	945	2.07	.0787	......	.1036	.0044	.0157
Eggs	.14	.707	424	1.35	.0084	.00026	.0339	.0012	.0152
Eggs	.24	1.21	247	.77	.0049	.00015	.0197	.0007	.0088
Beef roast (chuck)	.10	.376	797	2.52	.0023	.00085	.1115	.0079	.0929
Beef (plate lean)	.12	.415	722	1.72	.0021	.00077	.1010	.0072	.0842
Beef (round lean)	.20	.86	324	1.56	.0009	.00034	.0453	.0032	.0378

TABLE 2 (*continued*)

Food	Cost		Amount to be purchased for ten cents						
	Per pound	Per 3,000 calories	Calories	Protein (ounces)	Calcium calculated as Lime (CaO) (ounces)	Iron calculated as Iron (Fe) (ounces)	Phosphorus calculated as Phosphoric acid (P_2O_5) (ounces)	Magnesium calculated as Magnesia (MgO) (ounces)	Potassium calculated as Potash (K_2O) (ounces)
Oranges	$0.06	$1.06	281	.21	.0103	.00005	.0084	.0037	.0393
Prunes	.18	.50	644	.15	.0042	.00019	.0171	.0064	.0856
String beans	.15	2.55	177	.22	.0069	.00014	.0110	.0060	.0391
Cabbage	.05	1.239	242	.44	.0172	.00028	.0225	.0065	.1149
Chocolate	.35	.38	790	.57	.0052	......	.0368	.021	....
Bacon	.20	.25	1,420	.75	.00004	.00009	.0189	.0014	....
Butter	.34	.29	1,026	.04	.0010	......	.0013	.00003	.0010
Sugar	.06	.09	3,025	......	......	......	......	......	....

The Journal of Home Economics for October, 1910, reports an experiment made to show the relative cost of several much-used cuts of meat. The following table is adapted from that report:

Kind of meat	Cost per pound as purchased (cents)	Percentage of edible meat	Cost per pound of cooked meat obtained after deducting waste and loss (cents)
Beef loaf	15	72	20
Round (braised)	15	61	24
Short ribs (boiled)	10	36	27
Rib roast	15	41	37
Porterhouse roast	25	41	62

Another interesting experiment is reported, which shows the relatively high price that is paid for such a food as chicken. This is because of the large amount of waste.

Cost per pound live weight	Weight		Edible meat cooked (pounds)	Cost of cooked meat per pound (cents)
	Live (pounds)	Dressed (pounds)		
16 cents	4.65	4.09	1.11	74

The housekeeper should conduct her own experiment station and make experiments such as the above. She may thus soon find herself able rightly to estimate values.

The following paragraphs are taken from an article entitled "Why Food Is Costly," written for Good Housekeeping by Dr. Eugene Davenport, Dean of the College of Agriculture, University of Illinois:

"Everybody understands that food values are often controlled by trade conditions and even by trusts, but that really high prices of necessities are possible only when the buying power of the masses of men is great, and that anything which makes the wage-earner unable to continue to buy the same foods as his employer will of itself operate to lower prices.

* * * * * * * *

"Consider for a moment what the present generation has witnessed and what it has fed upon. Thirty or forty years ago, and speaking for the

masses of the people, nearly everybody owned his own cow and she fed upon the public domain. Milk and butter produced under such conditions cost nothing but labor, and that was largely furnished by the cow herself in collecting her free pasturage. Now, the same products are made almost exclusively out of forage and grain raised on land worth from fifty to three hundred dollars an acre, and they are delivered to the customer in costly packages, bearing frequently the name and guarantee of the producer.

"Then the cow and her calf cost next to nothing. Now they are not only fed at large labor upon costly food, but they are housed in expensive buildings, which the law as well as public sentiment demands must be kept in sanitary condition. Then milk and butter were incidental outputs of the home. Now they are the products of skilled labor, especially trained. Cows good enough to be kept under such conditions are not had for nothing, but represent something less than one out of three of the total cow population born, and it is not strange that they cost from $60 to $120, or even much more if purely bred.

"All this must raise the cost to the consumer, and still other elements of cost are being added. We are now demanding, for example, the tuberculin test, which must raise still more the cost of both milk, and its products, not only because of the cows destroyed by the test, but also because the business is necessarily passing into the hands of better men. The reader and the housewife should remember, too, that milk at 10 cents per quart and butter at 35 or 40 cents per pound are not more expensive than meat at 25 cents.

*   *   *   *   *   *   *   *

"Someone has said that the time has come when to fire a cannon represents the cost of a college education and to build a battleship costs a university. These considerations will one day amend public policies, but it will only increase the demand for bread, and now that we are checking the agencies of human destruction, we must understand what it will mean in population. Every life saved and every infant preserved adds not only to numbers but to the average length of human life and, correspondingly, to the demand for food.

"I cannot see, therefore, any lasting relief from the prospect of permanent high prices for food. Improved methods of production will defer the day and soften its coming, and reduced wages, consequent upon a dense population, will result in a forced demand for a lessened amount and a cheaper kind of food for the masses, and this, more than all other causes, will keep prices in check. But back of it all lies the fact of the pressure of population and the lessening fertility that no race yet has ever

stood against nor can stand against except by new and permanent methods of agriculture such as have not yet been generally established.

"We cannot afford to live in a fool's paradise in this matter. The day of cheap meat is over and that of cheap white bread is passing, and unless we can speedily establish a more permanent agriculture than has ever yet been established, then will prices not only go higher, but the most of men will be forced to subsist on the cheaper foods. This for sociological reasons, as well as for considerations of humanity, is eminently undesirable. The era of high-priced food is fairly upon us in spite of our 'boundless (?) natural resources' and our 'inexhaustible fertility,' and the most that we can do is to retard the speed and soften the hardship of its coming by a timely and scientific attention to our agriculture.

"Much is expected through reclamation of arid regions by irrigation, but the areas are relatively small, probably all told not exceeding that of Illinois, and the great staple grains, grasses, and meats will always be raised on non-irrigated lands. These are largely occupied already. The largest relief comes in breaking up the range for grain farming, but this means the last of cheap meat, and it means neither a permanent food supply nor a final reduction in price. The permanent food supply is attainable only by permanent systems of agriculture that increase instead of decreasing fertility, and even these do not prevent population from overtaking production. In the end high prices for food are inevitable, and it looks as if we had fairly started on the road, and if that is so, the only financial relief is cheaper food or less of it.

"I am in all things an optimist, not a pessimist, but we cannot afford to close our eyes to very evident facts. We have lived as have no other people in a superabundance of food. That time is over. I expect fluctuations in prices; but, for the reasons outlined, I believe that the era of cheap food is past forever."

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 29 | ITHACA, N. Y. DECEMBER 1, 1912 | FOOD SERIES No. 7

COST OF FOOD

DISCUSSION PAPER

The object of the discussion paper is twofold: first, it gives an opportunity to the reader to classify her knowledge on the subject treated; second, it enables the reader to contribute interest and ideas profitable to the success of the Reading-Course. Many ideas helpful to other readers are thus put into the "exchange" system; one object in the course is to "pass on" needed information. No contributor's name will be used without her permission. Even though a member thinks that she has nothing valuable to contribute to the course, she will nevertheless afford much satisfaction to the Supervisor of the Reading-Course if she will answer questions and thus show her interest.

1. Which is a cheaper source of iron, eggs or white bread?

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2. Which foods are the cheapest as a source of

Energy Protein Lime Iron

Phosphorus Potassium Magnesium

3. Is it possible to obtain, for 10 cents a day, all the energy and nutrients needed by the grown person?

Name. . . . .

Address. . . . .

Date. . . . .

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 31 | ITHACA, N. Y. JANUARY 1, 1913 | SANITATION SERIES No. 2

HOUSEHOLD BACTERIOLOGY *

MARTHA VAN RENSSELAER

In the vegetable kingdom there are micro-organisms that are the smallest and simplest plants known. They live in soil and in water and are found on the surface of foodstuffs. Some varieties prey on man and beast and plant. They number hundreds of species, some of which are of great value in nature's economy and of great benefit to man, while others are sources of danger to the health of man and animal.

Dust is a conveyance of such micro-organisms. In itself dust is practically harmless, although it irritates the mucous membrane, scratches furniture, worries the housekeeper, and occupies space needed for something else. We cannot get rid of this old enemy; there will be dust as long as there are people and furnishings. Wind is an agent for distributing it. Housekeepers have probably always asked the question, "Where does all the dust come from?"

FIG. 24.— *Moving the dust and germs from one place to another*

THE DUST GARDEN

Let us have some dust gardens to study, and note what will be produced. A garden presupposes plant life. Every garden has weeds, as

*The author is indebted for assistance in the preparation of this bulletin to Miss Maria Elliott, Simmons College; Dr. V. A. Moore, Dean of the New York State Veterinary College; and R. A. Pearson, formerly Commissioner of Agriculture for New York State.

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well as plants that we do not call weeds because they are being fostered. In the same way our microscopic dust-garden will have both non-useful and useful plants. In the ordinary garden, weeds that are visible may be destroyed with a rake or a hoe. In our dust garden are plants that are invisible to the naked eye, and the gardens in which they grow may be the food on our table, our own bodies, or the dust in our houses. These countless invisible living organisms affect us although we cannot see them. We ascribe the products of their activities to various causes. They are active and powerful in bringing about certain amazing transformations in matter, but we need more than the lens of the human eye to detect them. Since either good or harm may result from the presence of these invisible living individuals, we find that it is as desirable to cultivate some as to exclude others.

FIG. 25.— *What grew in a dust garden*

FIG. 26.— *Another dust garden*

Glass boxes, fitted loosely with glass covers through which much that takes place inside may be seen, are shown in Figs. 25 and 26. One day these glass boxes served as garden beds.

The soil used was a kind of beef-broth jelly. The seed was ordinary dust from an ordinary room. The boxes had been baked for over an hour in a very hot oven. The jelly had been steamed a number of times, until no living thing could possibly be therein.

A dust garden planted after a room had been carefully swept is shown in Fig. 25. When the cover of the box was removed and the dust raised by the broom into the air had settled on the soft, sticky jelly, something happened! In about twenty-four hours little specks appeared, which rapidly or slowly grew larger and developed various colors. Unfortunately, the photograph does not show the delicate greens, yellows, and blues of the different spots. As they grew larger some spots revealed a feathery or velvety surface and, like that at the left side, a dark center with dust flying from it. The other spots were shiny, wet, or waxy in appearance, and never showed any increase in height or any dark, dusty center.

Every housewife who has seen mold on her bread or on her jelly, in her pickle jar, or possibly on shoes and books, will suspect that the velvety, dark-centered spots are of similar nature. Molds spread their cells over the food, sending some cells down into the substance and others upward. From the tops of the upright cells grow others, and in or on them are formed thousands of dust-like specks, called spores. Each of these spores may start a new bed of mold. The infinitely tiny spores falling on soft substances, such as cheese or bread, send invisible lacy threads down into the substances; while on books, leather, wood, or cloth they may grow only over the surface and may remain invisible.

Certain spots in the dust garden are colonies of bacteria. Each spot shows where one plant or cell touched the jelly. This cell fed, and divided itself in the middle. These two cells repeated the process, until perhaps there were a hundred or more. Then a tiny speck became visible. No one ever saw, with the naked eye, a single bacterium or a mold spore.

In Fig. 26 is shown a dust garden with soil exactly like that of the one shown in Fig. 25, but the dust that planted it was thrown into the air by using a feather duster.

KINDS OF PLANT MICRO-ORGANISMS

Dust plants are micro-organisms. There are large numbers of minute organisms so small that they cannot be seen by the naked eye but require the aid of a powerful microscope to show their presence; hence their name, "micro-organisms." Various names have been given to these minute living bodies, such as "germs" and "microbes." Literally, germ means the beginning, the first living cell that produces a more complex form.

The plant micro-organisms that we shall consider are bacteria, molds, and yeasts.

Bacteria

Bacteria are carried on particles of dust, in liquids, and on the surface of fruits and vegetables as well as other articles of food exposed in the market. They may possibly find their way into the house by means of drains, and they are carried by insects. Normally, they are found in the air, in the soil, in water, in food, in the mouth and the digestive tract, on the skin, under the nails, in the hair, in the clothing.

Bacteria are reproduced by a process of division known as "fission," some of the different forms of which are shown in Fig. 27. The rapidity of reproduction depends on warmth, moisture, and food supply. Some species produce a new generation every half-hour; thus a single bacterium, if its growth were totally unchecked, might become in twelve hours an ancestor of sixteen million descendants. In two days the descendants

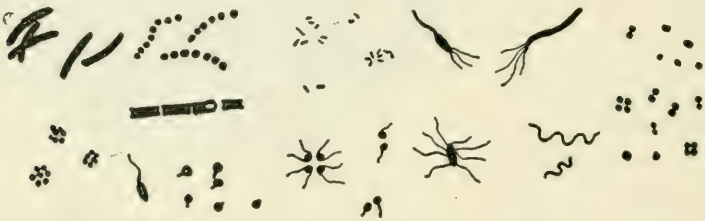

FIG. 27.— *Various forms of bacteria, or germs, showing different methods of fission. Greatly magnified*

would fill a pint measure. This rapidity of reproduction does not occur, because there are countless checks to the life of every species of bacteria.

We may form some idea of the minuteness of bacteria when we consider that the length of a single bacterium of some species is 1/25,000 of an inch. Many thousands of them may be packed into the space that a grain of sugar would occupy. If one falls into a minute wrinkle of the hand, it is as though it had fallen into a deep ditch.

Molds

Molds also are micro-organisms. A colony of mold organisms growing on some substance forms a velvety pile having a dark center. We often see long threads budding and branching to form a network over food. Each head produces thousands of dust-like spores. Some molds grow with less moisture than is required for bacteria, and some flourish in the light. They are frequently found in bread, on meat, on leather, and on sugary liquids. They increase very rapidly after rainstorms, and wind affects them less than it does bacteria.

Mildew is a form of mold found on moist clothes that have not been exposed to the fresh air. Mustiness is an indication of mold. Ringworm is due to this species of organism, which gets under the skin and causes inflammation.

Yeasts

The illustrations do not show a third kind of plant micro-organism which, especially in the country, is often present in house dust. That organism is yeast, which also is a single cell but which is reproduced by little buds that swell out from the parent cell and may or may not break off later. Those that float freely in the air, both inside and outside the house, are called "wild yeasts." So far as shape, size, and method of reproduction are concerned, these are little different from the cultivated yeast plants used to raise bread or to give the "sparkle" to sweet fermented liquids, such as beer.

As the invisible yeast plants can remain alive for a long time without moisture, we may have them furnished to us in dried cakes as well as in the fresh compressed form.

To-day, even with the cultivated yeasts, the housewife who mixes her sponge in a dusty room, in dusty utensils, with old yeast — or with everything clean and fresh, if she lets the sponge rise too long or keeps it too hot — is likely to have sour bread. Bacteria can grow well when and where yeast cannot, so that acid will be made from the alcohol that the yeast makes from sugar. The yeast plants grow best at a medium temperature, about 75° to 90° F., which is an average "summer heat." In a temperature above 90° F. yeast cannot grow so well, but bacteria grow better.

The little yeast plant, although so small and simple in structure, is endowed with many of the powers of trees and vegetables and other higher plants. It requires food, has a certain range of temperature in which it grows best, and is injured or killed by too high or too low temperature or by too little moisture. If it be given favorable conditions it will feed, grow rapidly, and reproduce itself by swelling out one part into a bud, which may or may not break away from the mother cell. The most favorable temperature for the rapid growth of the yeast plant, as already stated, is 75° to 90° F. Below that temperature the plant will not grow rapidly and therefore cannot do much work; at a temperature much above 90° it will be killed, and a dead plant cannot work any more than a dead animal can.

The work of the yeast plants is to change the sugar in bread sponge into two substances — alcohol, and a gas called carbon dioxid. The millions of little bubbles in the sponge cannot break through the sticky gluten

of the flour, so they raise the whole mass. When the bread is baked the gas is dissipated, the gluten walls of these bubbles are hardened, and little holes remain, filled with air only. The alcohol, too, is driven off by the heat.

It is very difficult to keep weeds out of the vegetable garden because their seeds are carried to the soil in many ways. When the weeds have sprouted or grown a little, they may be pulled up easily. In the bread-garden we want only yeast to grow, but it is very difficult to insure its growth alone since in the bread garden neither the good plants nor the weeds ever become visible. In no other way does household bacteriology interest the housekeeper so much as when connected with the baking of her bread.

Compressed yeast-cakes and dry yeast-cakes consist of a mass of yeast plants mixed with some form of starch and pressed into cakes. One yeast-cake may contain one half-billion yeast plants. It should contain only one species of yeast, but oftentimes other plants gain access to the mixture. If a compressed yeast-cake has been kept over a day or two it begins to turn dark and to soften. That is an indication that the yeast plants are dying and that bacteria have gained access to the cake, thus causing decay. The cake should then be discarded, for it will not make good bread. If dough is left too long or if it is kept too warm, the yeast plants become weakened; then the bacteria that may be present grow and produce an acid, making the bread sour. We scald the milk used in making bread in order to destroy the bacteria present. We bake bread for a full hour, or longer if the loaf is very large, in order to kill bacteria, yeasts, and molds, as all three may be present in a poorly baked loaf of bread and interfere not only with the keeping quality of the bread, but also with the health of the consumer. The careful housekeeper will have clean dishes in which to measure her ingredients and to mix her bread. She will not sweep nor cause a dust to rise in the room where she makes her bread, because bacteria are in that way raised into the air and may settle on her dough. She will cover the dough in order to keep out dust. With all her care there will always be some bacteria present, but they do not thrive in the sugar solution so well as healthy yeast plants do and at the temperature used for bread-making they do not grow so rapidly as do the yeast plants. They like the alcohol that the yeast makes from the sugar, however, so dough is kept at summer heat only long enough for the yeast to produce sufficient gas to raise the bread but not long enough for bacteria to get a start. It is better not to wrap cloth around hot bread just taken from the oven, because moisture and warmth favor the growth of bacteria and bread that is cooled slowly may not keep so well as if cooled more rapidly.

GERMS THAT ARE NOT HARMFUL

Some bacteria are of great value in the economy of nature. Man's bacterial friends have been found not less active than, and many times as numerous as, his bacterial foes. To his bacterial friends he owes the fertility of the soil by which plants are nourished. They tear down organic matter and pass it back to its simpler elements through the process of decay, thus ridding the earth of many harmful substances. This is the work of so-called nature's scavengers. There is advantage in what is called incipient decay. When bacteria grow in food the products of decomposition are different from the original nature of the food and produce new odors and tastes. We often need the flavors thus produced to stimulate the flow of the digestive juices. The gamy taste of meat is due to the beginning of decomposition of some of its constituents, and the strong flavor of limburger cheese is owing to the same cause. Gamy food, however, soon becomes objectionable; and cheese is ruined by the development of a too strong flavor of putrefaction.

The most common substances that owe their flavor largely to the presence of bacteria are butter, cheese, and vinegar. Without bacteria, butter, like "apple-pie without the cheese," lacks flavor; while cheese without bacteria would be like "the play 'Hamlet' with Hamlet left out"— an utter impossibility. When you next enjoy the acidity of a pickle, remember to give credit for that pleasant sourness to certain tiny plants, such as those that you have seen massed together in enormous quantities in "mother" of vinegar. Whenever a liquid containing a small amount of alcohol cider, for example, is exposed to the air, bacteria find therein a home and food. A film similar in nature to "mother" spreads over the top of the liquid and before long the alcohol becomes acetic acid, with vinegar as the result.

Our Puritan grandmothers would have thought us bewitched had we been able to tell them that their cheeses, on which they spent so many watchful hours, owed their making and their flavor largely to invisible plants. Even now scientists are unable to explain this process fully, although they are certain that there could be no cheese without bacteria.

From none of the harmless bacteria do we get more real enjoyment than from those found in butter. Long before the science of bacteriology and the days of cream separators, it was known that cream set to rise by its own lightness, skimmed, and left standing for several days would "ripen" and make far better butter than fresh cream. Butter made from ripened cream was found to taste better, keep better, and be made more easily than that made from unripened cream. We needed the bacteriologist to find the cause and to prove it to be the presence of bacteria; but long before his day the thrifty housewife had made use of the

principle involved, and had unknowingly availed herself of the assistance of the invisible plants.

The action of bacteria is very useful in the production of linen, jute, and hemp, in the tanning of leather, and in the maceration of skeletons. The destruction of garbage by means of the septic tank is owing to a certain class of bacteria.

METHODS OF DESTROYING THE EFFECTS OF BACTERIA

Heat

All bacteria are promptly killed by heat unless they are in the spore form or the resting stage. There are resting stages of some of these organisms when the conditions for active life are unfavorable. The organism itself may dry up and assume a dormant form, resuming its active form when favorable conditions recur; or it may throw off spores. Spores resist heat far better than does the active or vegetative organism; so, although we may have used enough heat to kill the active forms, we cannot be sure that we have destroyed all organisms unless we know that the particular organism which we seek to exterminate does not form spores or is not in the spore stage. Boiling for twenty minutes will generally, but not always, kill most forms of bacteria, including the spores. Water is pronounced safe when it is thus boiled. Mere simmering of water is not sufficient.

Fresh air and sunshine

Direct sunshine kills most bacteria. Many persons are afraid to take fresh air and sunshine in sufficient quantities to counteract the bad influence of dark rooms, moisture, and poor air; yet, of all the bactericides known there is none that compares in effectiveness with sunshine. Much suffering would be saved if persons could only be brought to a realization of this fact. Airing and ventilating bedrooms, kitchens, cellars, and stables aids much in keeping them wholesome.

Drying

About thirty per cent moisture is required for the growth of bacteria. This fact is the principle utilized in the preservation of many of our foods. In order to preserve seeds we dry them, and they do not begin to sprout until they are moistened when needed for planting. Flour is practically free from decomposition because it is dry, and a cracker keeps indefinitely for the same reason. In some regions, tons of fish are prepared for market by drying. Fruits, such as berries, raisins, apricots, currants, prunes, and apples, are preserved in this way. Dried beef has long been a familiar example of the application of this principle. It must be remembered

that drying only arrests the growth of bacteria, and that when food has over 30 per cent of moisture there is danger of its spoiling. Dried foods are therefore kept in a dry place so as to prevent absorption of moisture and consequent spoiling.

Cold-storage

As a means of preventing putrefaction and decay, storehouses are cooled artificially and a low and constant temperature is maintained. Eggs, fruit, vegetables, and the like may be kept for a considerable period of time if they are frozen, and may then be delivered at the market in fair condition for use. There is some question, however, regarding the safety of the use of cold-storage foods, for food deteriorates quickly if it is taken from cold-storage and not used immediately thereafter. As long as meats are kept frozen they may be preserved indefinitely. Ordinary ice-chests are very efficient for arresting the growth of bacteria, although the temperature in them is higher and less uniform than in cold-storage and they cannot be depended on for keeping foods for any length of time. Bacteria grow very slowly, however, in an ice-chest. The same statement is true regarding certain materials that have antiseptic power in a cool cellar.

Preservatives

Antiseptics are materials that retard or prevent the growth of bacteria. They may be used for the preservation of foods, but they should be harmless to man. Substances often used as preservatives are borax, boracic acid, salicylic acid, and formalin. In small quantities these preservatives have not been found to be very injurious; yet their use in manufactured foods has been made illegal in many States, as their presence in food might quickly lead to the consumption of amounts sufficient to be harmful. The housekeeper never knows how much preservative may have been used before articles of food come to her, hence it is safe for her never to use any preservative but to depend instead on the bactericidal action of heat. It is not known how much the digestive organs can endure from borax and similar materials, but experiments seem to show that such materials have a detrimental influence.

Harmless preservatives.— (a) *Sugar.* A heavy sugar solution prevents the growth of bacteria. In the proportion of 40 or 50 per cent, sugar makes an excellent preservative and is commonly used in this amount in the preparation of jellies, marmalades, and preserves and in preserving raisins, figs, and candied fruits. Condensed milk is also preserved by the addition of 30 or 40 per cent of sugar.

(b) *Salt* is very commonly used in the household to prevent bacterial growth. The housekeeper uses it for keeping fat pork, for corning beef and

bacon, for preserving eggs, hams, fish, and the like. Butter and cheese are salted partly for flavor, but largely for the sake of making them keep better.

(c) *Acids* protect food from bacteria and give a new flavor that many find acceptable. In making pickles we soak cucumbers in brine and add vinegar and spices to preserve them. The brine sometimes becomes covered with a scum, owing to bacterial growth, and the pickles grow soft through decay; these facts show that salt by itself is not a perfect preservative. The remedy in the case of the pickles is to scald them, in order to destroy micro-organisms. Other acids are known to preserve foods. This is the case with sauerkraut, which is protected from bacterial growth not only by acetic acid but also by lactic acid, produced by allowing bacteria to grow in the sauerkraut. The resulting acid finally destroys the organisms that have produced it, and aids in preventing the entrance of others.

(d) *Spices* are antiseptic and are added to foods in order to prevent putrefaction. Mincemeat is a good illustration of this practice. The apples and meat would putrefy very quickly were it not for the spices and boiled cider that are added to prevent putrefaction. We add sage and spices to sausage for the same purpose, while fruit cake is kept for a long time by the same means. Hops not only give a nutty flavor to bread and food in which they are used, but also have a slightly antiseptic action.

Canning

Canning keeps fruit and vegetables free from all bacterial growth because it first destroys all life present and then provides for complete exclusion of further organisms. As bacteria are found on utensils, in the air, and in water, and all food materials contain them, we first destroy the bacteria by boiling the food, and then seal the can, which has been thoroughly sterilized, in order to prevent the entrance of bacteria. The housekeeper has learned that a single bacterium in a can is sufficient to destroy the entire contents. Formerly she might have said, "I do not lose many cans of fruit in a year." With her present knowledge of the necessity for complete sterilization she may say, "I never lose a can of fruit."

This statement is made possible only by thorough sterilization and hermetic sealing of the receptacles used in canning. Some articles of food have to be cooked for a long time before becoming completely sterilized, because they contain spores that may resist ordinary boiling. Most failures in canning are owing to the use of insufficient heat or to failure to sterilize all the utensils used, thus leaving spores, which, developing later, will spoil the material canned. Spores get in accidentally. It is necessary

to prevent the raising of dust and to avoid the use of cloths or utensils not thoroughly cleansed. Persons will give themselves much concern in sterilizing fruit and jars, and then wipe out the clean jar with a dishcloth or let their fingers come in contact with the inside of the jar. Everything that comes in contact with fruit or receptacle should not only be clean but should also be sterile.

Cans must be sealed while still hot, so as to sterilize any air present. New rubber rings should be used each year, as they need to be soft and elastic, and they should be heated in water before being used. Sterilization can be accomplished much more thoroughly in factories than in private houses, because the former have equipment to produce sterilization under pressure. Never is the housekeeper more conscious of the necessity of exact laboratory principles than when she is canning her fruit; it is a piece of work of which to be proud, when she does it with the exactness of scientific principles.

DISEASE GERMS

A growing knowledge of bacteria has done much toward preserving or prolonging life. Some persons still state that they are happier if they do not know too much about germs. They affirm that before germs were known people were just as healthy as, and much happier in their ignorance than, at the present time. They confound knowledge with fear. Knowledge teaches prevention; fear preys on the mind. A lack of knowledge of how to avoid infection is inexcusable among the intelligent. An infected person should be isolated for the welfare of his fellow-beings, even though he is suffering merely from a cold. Every one now understands that a cold is contagious. With isolation to prevent others from becoming infected, and disinfection to kill already existent germs, sickness and the death rate would be soon and greatly reduced. A student who was interested in his work had mumps. He was asked by his instructor to remain away from class until he was well. On his refusing to do so, the dean of the college told him that he must leave the college until he was pronounced safe. The student said that he could not understand why he should not remain in the college because it was *his* mumps. The truth is that he could not keep his mumps to himself.

Some micro-organisms are parasites that produce disease. They feed on living plants and animals. Other micro-organisms live on both living and dead material. They are only partly parasitic and are capable of producing disease. These microbes that cause disease are said to be "pathogenic." It is now known that microbes are the cause of many of the contagious or infectious diseases, such as tuberculosis, diphtheria, and typhoid fever. The better the conditions for the propagation of these

injurious germs if they should gain entrance, the greater is the danger of disease.

There is reason to hope that at no very distant day the spread of infectious diseases may be controlled, since it is generally known that there are specific living disease germs that pass from a patient to another person. If a person becomes infected with disease germs it is quite possible for him to pass on these germs to others through careless habits. Cases of sickness cared for at home — and this covers a large percentage of cases — make it necessary for the housekeeper to safeguard members of her family, as well as other persons, by a knowledge of bacteriology and a strenuous care to prevent infection. In the hospital such safeguarding is much more easily managed. Hospital methods, however, may extend to the home.

PRACTICAL APPLICATION OF PRINCIPLES OF BACTERIOLOGY

Thoughtfulness, together with a knowledge of the results of bad habits, brings many things to our notice to which we may have previously closed our eyes. We are prone to object to dirt without stopping to consider whether it is harmful dirt. Our housekeeping sensitiveness worries us if a neighbor calls and sees dust on the table. This dust may be less harmful, however, than a spoon dipped into the food that the cook is preparing for a meal, and then placed again in the food without being washed.

Kissing.— Kissing is a custom as old, probably, as the history of human beings, and no doubt to be continued but to be indulged in only when persons are in a healthy condition. Mothers are able to control the custom of kissing babies for a short period; they may lay a ban on the kissing of their infants by the admiring public. They should even control their own desire to kiss their children when affected with tuberculosis or suffering from tonsilitis or other inflammatory condition of the mouth or throat.

> " If a body meet a body
> Coming through the rye,
> Can't a body kiss a body
> For fear of bacilli?"

Care of finger nails.— We may wash our hands thoroughly, but underneath the nails may be dirt, difficult to reach, which is a retreat for germs. Clean finger nails are always an asset, but in the handling of food they are essential to safety.

Coughing and sneezing.— For coughing and sneezing " in the open " there is no excuse. A handkerchief should be within easy reach to catch the offending spray from the mouth and nostrils. The truth of this statement is an argument for a pocket in a woman's dress, in which to keep the handkerchief.

Handling of toilet articles.— The fingers of the attendant may after such handling unconsciously carry to the mouth infecting organisms.

Care of discharges.— Body discharges contain the seed, or germ, of disease. These should not be left carelessly, as in the case of sputum, to dry and be wafted about by the wind, nor thrown in a loose vault and allowed to reach the well or a body of water from which drinking water is obtained.

Insect pests.—The fly is no longer unpopular merely because of tradition and because of its annoying bites and specks, but also because of the now well-known fact that it carries disease germs on its feet and in its body. Mosquitoes, too, are in disgrace, for without them malaria would trouble no one.

Common drinking glass *Recently washed glass*

FIG. 28.— *Public drinking cups*

BY COURTESY OF MEDICAL REVIEW OF REVIEWS

Other animal disturbers.— Rats harbor the flea that spreads the germ of the bubonic plague. Cats and dogs are the delight of children and of many grown folks, nevertheless they sometimes bring with them germs of diphtheria, scarlet fever, and other diseases.

The common comb and brush.— Common toilet articles, unless thoroughly sterilized, are to be avoided in the barber shop, shampoo parlors, and even in the family, because dandruff and some other skin diseases are infectious.

The common cough-medicine bottle.— The medicine bottle may contain not only an opiate to paralyze the nerves, but also a cold-germ from the lips of the last patient who has placed the bottle to his lips.

The common drinking-cup.— Public sentiment has dealt a blow to the common drinking-cup. We never think in our homes of using the same

glass at table; yet at school, and in other public places, promiscuous drinking from a cup is still too common, although railroads are fast abolishing the common cup. Laws have been passed in some States forbidding its use in public places.

Railroad dust.— The railway porter's income is derived partly from fees for brushing the clothes of passengers. The dust from the clothing of one passenger is stirred up and settles on the plush seats of the car and on the clothing and persons of his fellow-passengers. Dust and money are thus put into circulation! Considering the danger from germ-laden dust, it is possible that the back platform might be less dangerous than the car aisle as a place for the brushing. A better way still is for every passenger to do his own brushing, in private, on his own back doorstep.

Food exposed to dust.— It may be difficult to cover all the left-overs and all the food in process of preparation; but the housekeeper is likely to attempt to do this when she realizes that the surfaces of uncovered food catch many flying particles and germs that we would rather not have made a part of our diet. Probably, if the bread had not been left unprotected, the mouse would not have jumped into it. We can see the mouse, however, in time to avoid making him a part of our meal, whereas the obnoxious germ is so small as to escape notice. A table filled with left-overs, waiting to be prepared for the next meal, is a veritable dust-garden, and who knows what additions it may make to our diet? Of course, sufficient heat applied may kill anything dangerous, but we do not want dirt in our food even though the germs have been killed.

Food exposed in the market.— Housekeepers are promoting the interests of health when they buy only those foodstuffs that are protected, on wagons and in the market, from the dust of the street. Handling foods with clean hands necessitates in the grocery a place in which the hands can be washed frequently.

Washing clothes without boiling.— There are pieces in the laundry that should be boiled; handkerchiefs, bed linen, underclothing, and, in fact, all clothing are the better for sterilization. The newer methods of cleaning and pressing woolen suits are good from a sanitary standpoint. Cleaning processes involve steam, which is a sterilizer, and often gasoline, which is a partial disinfectant.

Tainted money.— No one refuses even a grimy, dirty bank-bill, but every one feels the need of washing the hands after handling it. Placing coins in the teeth shows decided lack of intelligence or reckless disregard of sanitary principles. The coins that pass through many hands may have become infected with the micro-organisms of diphtheria, tuberculosis, or other specific diseases.

Care of toilets.— Public and private toilets should be disinfected very frequently. The basin, bath, and the seat especially, need careful washing with a disinfecting solution. Cloths and brushes used about the toilet should be scalded and not used for other purposes of cleaning.*

Careless dishwashing.— The thorough washing of pans, kettles, and cans makes housework and cooking far from easy, but in the long run it is easier than caring for sickness or being disabled. It is not so difficult to do the cooking when some one else does the cleaning up. The fewer the creases in a cooking utensil and the more it is scalded, the better. Sun and hot water are most beneficial agents for the safe care of kitchen utensils.

The refrigerator.— The refrigerator might be called on to tell many tales of the life history of germs, for its recesses hide a multitude of secrets. Slime left where the ice has melted shows the need of care in cleaning the refrigerator, for here is food for bacterial life. The spilling of food on the shelves is another source of the same trouble. Ice should be well washed before being placed in the refrigerator. All bits of food should be removed from the shelves and crevices, the refrigerator should be often washed and scalded, and some antiseptic, such as washing-soda, should be used. The chill of the refrigerator retards the growth of micro-organisms, but probably does not destroy them.

BACTERIA AND MILK

As milk is one of the most important foodstuffs, especially for children, it is very important that every housewife should understand something of the effect of bacteria on it. Every one knows that milk contains a certain number of bacteria. Some of the germs are in the udder itself, but most of them get into milk after it is drawn. Dirty cows, dirty barns and stables, dirty hands and clothes of the milker, and dirty utensils all contribute to increase the number of germs in milk. If the milk is not properly cooled and kept cold, bacteria multiply and produce many changes in it which often trouble nurse and cook.

The most common of the difficulties encountered in caring for milk is the simple souring, or lactic-acid fermentation. In addition to this well-known process, there are a number of other and more troublesome changes, such as the appearing of bitter milk, slimy milk, and tainted milk.

The lactic fermentation, or common "souring," of milk is brought about by a number of species of bacteria. Formerly it was supposed that a single species produced this change, which consists in the splitting of the milk-sugar molecule into carbon dioxid and lactic acid. It is

* A lesson on disinfection is in preparation.

now known, however, that in the process of splitting up the milk-sugar other by-products are produced. In the simple lactic type of fermentation these secondary products are not very important. It should be noted, however, that in the souring of milk by different species of bacteria, correspondingly different by-products may result. In consequence of this the souring is often accompanied with by-products that are undesirable, if not injurious, to the consumer. In such cases the deleterious substances are often produced before the quantity of acid is sufficient to cause curdling. In fact, the by-products themselves may become harmful while the milk is still considered sweet and wholesome. The most telling truth that comes to us from all inquiries on the subject is, that different bacteria causing souring in milk produce very different effects on the milk itself, as is shown in the rapidity of the souring and in the types of fermentation accompanying it.

Much has been written concerning disease-producing bacteria in milk. They belong to two distinct classes, namely: (1) The specific bacteria of certain diseases of cattle, which may, if the animal is suffering from disease, gain entrance to the milk. In this class may be mentioned tuberculosis, foot-and-mouth disease, and possibly anthrax. (2) The bacteria of certain human diseases, such as typhoid fever and diphtheria, and the virus of scarlatina and measles. A large number of epidemics of these diseases has been traced to the milk supply; through it the infections occurred. The explanation of this is, that in cases in which the diseases existed among the attendants or in their homes, sufficient care was not taken in handling milk to prevent the entrance of the disease germs. In the case of typhoid fever the water used in rinsing utensils may be contaminated. In cases of diphtheria it often happens that those who have recently apparently recovered from the disease but still have the bacilli in their throats, are engaged in milking or in otherwise handling the milk, when, by sneezing or coughing, the bacilli from the throat may be introduced into the milk. The sad experiences of the past are teaching the importance of taking reasonable precautions against such infection.

When digestive disorders, especially among children, follow the use of milk containing many bacteria, the immediate cause is quite as likely to be the acids and other by-products that have been produced in the milk by various forms of bacteria, as the activities within the digestive tract of any one or more species of the micro-organisms consumed. We must look to the effect of bacteria on the milk itself for the cause of many, but not all, of such ailments. It is to prevent those effects that pasteurization is employed.

Milk is sterilized or pasteurized for two purposes: to keep it sweet for a longer time than would otherwise be possible, and to kill all harmful

bacteria that it may contain. *Sterilizing milk means boiling it for a certain length of time*, or heating it nearly to the boiling point, allowing it to stand for some hours and again heating, repeating the operation several times. Boiled milk is very difficult for children to digest. *Pasteurization* is accomplished by bringing milk to a temperature of 60° to 65° C. (140° to 149° F.) and holding it there for twenty minutes, after which it is cooled quickly. This process does not affect the taste of the milk, and such milk is more readily digested than is boiled milk. We should not need to depend on sterilizing or pasteurizing as a means for providing germ-free milk. The milk should be produced in a clean manner, for clean raw milk is more wholesome for children than cooked milk, no matter what the method of cooking may be. Hot air and steam are valued germicidal agents; hence their wise use in the dairy.

The cow not only needs wholesome food, but also needs to be kept clean. From the time the milk leaves the udder there is danger of its contamination.

Look first on this picture: A milkman dressed in clothes brushed clean, his hands washed in soap and water, not simply rinsed at the trough, his finger nails short and clean; the cow curried, her udder washed; the pail to be used covered until needed for the milk; the stable clear of dirt. Look next on this picture: The cow lying in her own dirt overnight, her udder soiled; the milkman dressed as he has been while doing all sorts of work; the cow's tail switching and dirt flying; flies bothering the cow until she kicks — if not into the pail it is only careful management that has prevented such an occurrence. Milk produced in the latter way is hardly worth buying; while for that bought from the former milkman we can afford to pay a good price — enough to encourage a man to keep clean and to have clean stables and cows. Pay enough to allow the farmer to have cement floors, tight ceilings, good ventilating devices, and general cleanliness. Then he will scrub his floors and will hang up his milking suit, to be used only while milking.

"We always strain our milk, and dirt and hairs are removed from it," say some. Yes, but we do not like to eat bread that the mouse ran over, even if the mouse has gone. A good part of the dirt that may get into milk is soluble and cannot be strained out. A diseased cow! We think it not profitable to throw away milk, but consider the danger to human beings of infection from the use of impure milk! It is safe to watch the cow, so as not to use the milk from a cow that is diseased.

The milk that a certain housekeeper was buying appeared at one time to be not quite right, and she interviewed her milkman. "Many hairs and much dirt in the milk," was her complaint. "Oh well," he said, "I have to hire my milking done and you know how it is, they won't

always be careful; I have told the man if the cow stepped into the pail to throw the milk away, but he won't always do it unless he is watched."

Tests were made some years ago by R. A. Pearson, at that time Professor of Dairy Industry at the New York State College of Agriculture, and by Walter E. King of the State Veterinary College, in order to determine the importance of different sources of milk contamination. Mr. Pearson has given the following as a result of these experiments:

" In most of these tests, a definite quantity of sterilized milk at 98° F. was exposed to some one kind of contamination that we wished to test. The milk was then examined and in that way we could get a fairly accurate idea of what this particular kind of contamination amounted to. Some of the experiments and their results are as follows:

1. " *Exposure to air in the stable.*— Two liters (about two quarts) of sterilized milk were placed in a sterile pail and exposed seven minutes to the stable air in a passageway behind the cows. This stable was doubtless cleaner than the average and the air contained less dust than is often found in places where milk is being handled. Immediately after this exposure, the milk was 'plated' and found to contain 2,800 bacteria per cubic centimeter (about fifteen drops); in other words, between 5,000,000 and 6,000,000 bacteria had fallen into the two liters of milk in this short time.

2. " *Pouring milk.*— When milk is poured from one vessel to another, a very large surface is exposed to the air and great numbers of bacteria are swallowed up. The following tests illustrate this point: About five liters of milk were poured from one can to another eight times in the stable air. It was found, after pouring, that this milk contained practically 100 bacteria per cubic centimeter more than it contained before pouring; in other words, about 600,000 bacteria had got into the milk because of this exposure. In another similar experiment, when there was a little more dust in the air, the contamination due to pouring eight times was two and one half times greater than in the preceding experiment.

" The importance of pouring milk as little as possible from one vessel to another has suggested to Dr. J. Roby, of the Rochester Health Department, that milking-pails should be made larger than those now used and immediately closed after the cow has been milked. The milk should then be cooled and delivered in these same pails without further exposure. In some ways this suggestion is a most excellent one, but it may be that under certain conditions the disadvantages of this method of handling milk would exceed the advantages.

3. " *Contaminated utensils.*— Much contamination of milk results from putting it into dishes that have been cleaned and then exposed where dust can fall into them. In experiments to determine what this kind of

contamination amounts to, it has been found that when little care is taken to protect the dishes, the milk will often contain several hundred times as many bacteria as when the utensils were protected from dust. In order to illustrate this point, two pails were carefully washed and sterilized. One of them was covered with sterile cloth to keep dust from falling into it. The other was left exposed to the air of a clean creamery for only a few minutes. A small quantity of sterile milk was then put into each pail, rinsed around, and then examined for numbers of bacteria. It was found that the milk in the pail which was not protected from dust contained 1,600 more bacteria per cubic centimeter than the milk in the protected pail.

4. "*Contamination from the cow's udder and body.*— Great numbers of bacteria fall into the milk when it is being drawn from the udder, because the milking pail is directly under the udder which is being shaken more or less by the milker's hands. This kind of contamination may be reduced by cleaning the udder. It was found that sterile milk exposed under the udder as long as it takes to milk a cow, and while the udder was being shaken about the same as when milk is being drawn, contained 19,000 bacteria per cubic centimeter. In this case the udder had been wiped off with a dry cloth much in the same way as is done in fairly good dairies.

"In a similar test, the udder was wiped with a damp cloth and then the number of bacteria was reduced to 4,500 per cubic centimeter. In a third experiment the udder was wiped with a cloth dampened in a 4-per-cent carbolic acid solution; then the number of bacteria was 3,200 per cubic centimeter. In cases in which no particular care is taken to clean the udder, the bacteria getting into the milk from this source may run up into the hundreds of thousands or millions.

5. "*Importance of small openings in milk pails.*— Thus it is seen that it is impracticable to clean the udder or free the air from dust so perfectly that *no* bacteria will fall into the milk. The next question is, how can we reduce the number of those that will fall in spite of all reasonable precautions? The easiest way known is to use a small-top milking-pail. Reduce the opening through which dirt can fall into the pail. An experiment was conducted to illustrate this point, and it was found that milk drawn in an ordinary milking-pail contained 1,300 bacteria per cubic centimeter, while that drawn in a pail with opening about one half as wide contained only 320 bacteria per cubic centimeter. This is just what we would expect when we compute the number of square inches through which dust can fall into the different kinds of pails. For example, a pail having a top 14 inches in diameter has an opening of 153.86

square inches; a pail with 12-inch top has an opening of 113.04 square inches; one with 10-inch top has an opening of 79.79 square inches; a pail with an opening of 6 inches in diameter has an exposure of 28.26 square inches.

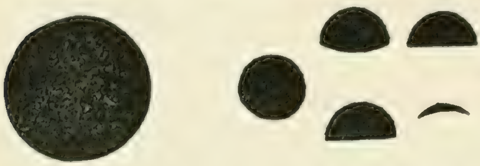

FIG. 29.— *Diagram showing size of openings in various kinds of milk pails. The large circle at the left represents the common milk pail. The others show the perpendicular exposure in the new kinds of pails*

"Milkers should get into the habit of using the small-top pail, as it is one of the easiest of all ways for reducing the number of bacteria that fall into milk.

6. "*Contamination by flies.*— A fly or a bit of hay or straw or a piece of sawdust or a small hair, may carry enormous numbers of bacteria into milk as is shown by the following experiments:

"A living fly was introduced into 500 cubic centimeters of sterile milk. The milk was shaken one minute and then it contained 42 bacteria per cubic centimeter. After 24 hours at room temperature, it contained 765,000 bacteria per cubic centimeter, and after 26 hours 5,675,000.

7. "*Dirt in the milk.*— A piece of hay about two inches long was placed in 500 cubic centimeters of sterile milk. The milk was shaken one minute and it then contained 3,025 bacteria per cubic centimeter. After 24 hours at room temperature it contained 3,412,500 bacteria per cubic centimeter.

"One piece of sawdust from the stable floor was put into 500 cubic centimeters of sterile milk. The milk was shaken one minute and its bacterial content was then found to be 4,080 per cubic centimeter. After 24 hours at room temperature it was 7,000,000 per cubic centimeter.

"A hair from a cow's flank was put into 500 cubic centimeters of sterile milk. After shaking the milk for one minute it contained 52 bacteria per cubic centimeter. After 24 hours at room temperature it contained 55,000 per cubic centimeter, and after 36 hours over 5,000,000 bacteria per cubic centimeter."

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SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 31 | ITHACA, N. Y. JANUARY 1, 1913 | SANITATION SERIES No. 2

HOUSEHOLD BACTERIOLOGY

DISCUSSION PAPER

This discussion paper, accompanying the lesson on Household Bacteriology, may be returned with answers to the questions and with any suggestions and questions of your own. While the answering of these questions is not absolutely necessary, a much greater benefit will be derived if you give to others the benefit of your own experience. It will also help us to understand your point of view. The lesson may be used in the grange and in the club where these subjects are considered.

1. The exposure to dust, in open store-windows and in wagons, of fruit and vegetables to be used later on the table is dangerous because the products collect on their surfaces germs that may be communicated to the consumer. Would it not encourage care on the part of the seller if housewives objected to purchasing such provisions? Discuss.

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

2. How much does the effort to make clean, wholesome surroundings really add to the amount of work in the house?

3. What do you consider the most important ways in which you can apply the knowledge gained from the study of household bacteriology?

Name..................................

Address..................................

Date..................................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 33 | ITHACA, N. Y. FEBRUARY 1, 1913 | GARDEN SERIES No. 1

VEGETABLE-GARDENING

ALBERT E. WILKINSON

Introduction by

L. H. BAILEY

"I wish that Americans would make gardens even if there were no hope that people would see them. The meaning of home has broadened and deepened very much within a lifetime. To the plainest home of the middle class there have been added a few good pieces of simple and useful furniture, a little collection of books good at least to look at, simple music, pictures that have some meaning and are not mere wall decorations: may we not now add a garden? It does not matter how small or how large the garden is. If it is small, it will be condensed and perhaps we shall appreciate it the more.

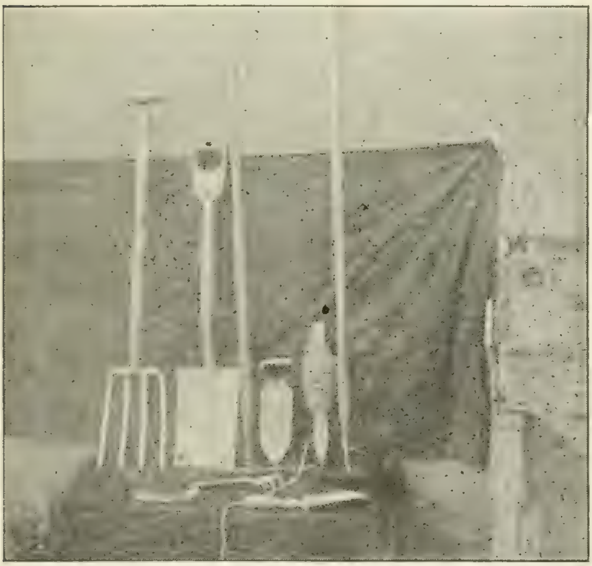

FIG. 30.— *Necessary garden tools*

"I step from the house, and at once I am released. I am in a new realm. This realm has just been created, and created for me. I give myself over to the

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blue vault of the sky; or if it rain, to first-hand relationship with the elements — for can I not touch the drops that fall from some mysterious height? I am conscious of a quick smell of the soil, something like the smell of the sea. I hear the call of a bird or a faint rush of wind, or catch a shadow that passes and is gone. There is a sudden sensation of green things tumbled over the ground. I feel that they are living, growing, aspiring, sensitive. Then the details begin to grow up out of the area, every detail perfect in its way, every one individual, yet all harmonious. The late rain compacted the earth; but here are little grooves and cuts made by tiny rills that ran down the furrows and around the stems of the plants, coalescing and growing as they ran, digging gorges between mountainous clods, spreading into islanded lakelets, depositing deltas, and then plunging headlong toward some far-off sea — a panorama that needs only to be magnified to make those systems of rivers and plains and mountains the names of which I dreaded so much in my old geography days. Soft green things push up out of the soil, growing by some sweet alchemy that I cannot understand but that I can feel. Green leaves expand to the sun; buds burst into flowers; flowers change to fruits; the pods burst, and berries wither and fall; the seeds drop and are lost — yet I know that nature the gardener will recover them in due season. Strange plants that I did not want are growing here and there, and now I find that they are as good as the rest, for they spring from the same earth yet are unlike all others, they struggle for place and light, and they too will have their day and will die away and in some mysterious process will come again. Insects crawl here and there, coming from strange crevices and all of them intent. Earthworms heave their burrows. All these, too, pass on and die and will come again. A bird darts in and captures a flying insect; a dog trots across the farther end of the plot; a cat is hidden under the vines by the wall. A toad dozes under a bench: he will come out to-night. It is all a drama, intense, complex, ever moving, always dying, always re-born. I see a thousand actors moving in and out, always going, always coming. I am part of the drama; I break the earth; I destroy this plant and that, as if I were the arbiter of life and death. I sow the seed. I see the tender things come up and I feel as if I had created something new and fine, that has not been seen on the earth before; and I have a new joy as deep and as intangible as the joy of religion."—OUTLOOK TO NATURE.

VEGETABLE-GARDENING

Often on the farm or at the town or city home, the actual planning for the home garden, as well as the carrying out of its details, is done not by the farmer nor by his man but by a woman. It is therefore highly important that helpful suggestions regarding the requirements of vegetables should be available to her.

PLANNING

In order to obtain the greatest success in any undertaking, it is important that a plan of operation should first be definitely decided upon. It is essential to have a well-drawn plan that will be readily understood even after it has been laid aside for a year.

If the prospective gardener will take a piece of paper at least 15 inches wide and 27 or 28 inches long, it will be possible, by a very simple method, to draw a plan of the garden. As the piece of paper is small, it will be necessary to reduce the size of the garden as represented on it. That process is called reducing to a unit, or scale. If we say that every foot of the garden can be drawn on paper by using the scale of ¼ inch, we have a unit of measure designated as " ¼ inch equals 1 foot." Using such a scale on a garden 30 by 30 feet, we should have a drawing measuring 7½ inches on each side. If the garden is larger than this the measurements on the plan will of course be correspondingly larger. By making use of a unit of measure, or scale, in our outline of a garden we can draw the rows as they should come, always remembering that for each foot in the garden we use one quarter of an inch on the paper.

How shall one know just what space to allow between the rows of vegetables, as well as between the vegetables in the rows? The planting-table given on page 1402 contains information on both those questions. It is very important to plan in such a way that small vegetables shall be grown toward the south and taller-growing vegetables toward the north. Such an arrangement will enable each vegetable to have sunlight without being shaded by taller-growing plants.*

SEEDS

After a proper plan for the garden has been drawn on paper, the next step is the calculation of just how much seed will be needed. The planting-table will be of assistance here, as it shows the amount of seed required for 100 feet of row. If the row in the garden is 50 feet long, the seed

*Lesson 34 of the Cornell Reading-Course for the Farm, Vegetable-Gardening Series No. 2, will be helpful in the planning of home gardens. For this bulletin address the Cornell Reading-Course for the Farm, New York State College of Agriculture, Ithaca, N. Y.

FIG. 31.—*More and more, women are engaging in commercial gardening*

required will be one half that given in the table; if the row is longer than 100 feet, the amount of seed needed will be a proportional amount plus that required for 100 feet. Always, however, the amount of seed should be made larger than is needed. When the seed list is made, the seed should be bought at the local store or from a reliable seed firm. There being a little more of each variety of seed than is needed for planting, it will be profitable to test the seed as to its power of growth.

Testing seeds

Choose ten average seeds of one variety. Provide a box 18 inches long, 12 inches wide, and at least 2 inches deep inside, and fill this box with good garden soil. Mark shallow lines in the soil one inch apart, at a depth about two or four times the diameter of the seed to be planted. Place the ten seeds in the first of the shallow marks, or furrows. Mark the box at the end of the furrow, on the wood, so that you will know the variety of seed that is planted in that row. Choose ten samples of another variety and plant them in the second row. Continue until all the varieties of seed bought have ten fair samples planted in the box. Then cover the seed in the rows with soil and press both hands flat on the soil. Sprinkle about a pint of water over the soil and place the box near the stove or in a sunny window where it will have a fair amount of heat. Water when necessary, during the next two weeks.

Mark on paper the date of planting the seed, and on each day set down the number of plants showing above the soil. If at the end of two weeks eight of the ten seeds in row 1 have shown above ground and are still healthy and green, the percentage of growth will be eighty; if six show, the percentage will be sixty; if nine show, ninety; and so on. If less than sixty per cent shows, more seed will have to be used in the actual planting of the garden in order to obtain the number of plants desired. This is the most valuable test of seeds, as it shows not only those that sprout vigorously but also those that under fair conditions will grow in the outside garden; and it is the seeds that will produce a crop that are desired for planting.

HOTBEDS AND COLD-FRAMES

For the greatest success in vegetable-gardening, it is necessary to have plants ready to set in the soil early in the spring. The cost of the plants, if they must be bought, is often so high that persons frequently do without them rather than pay the price demanded. It is, however, a very simple matter to construct hotbeds and cold-frames and to raise the plants oneself.

Not only is it possible to raise all the plants necessary for the early production of vegetables, but it is possible also, by the use of hotbeds and cold-frames, to raise, and later to enjoy, some vegetables long before

even the use of hotbeds and outside gardens could possibly produce them. Radishes, lettuce, spinach, beets, carrots, and other vegetables may be raised in the manner described and be available for the table at a season when the winter supply of stored vegetables is exhausted.*

PREPARATION OF THE GARDEN

Location

If possible, choose for the garden a piece of land that has been under cultivation for two or three years. If the land slopes slightly toward the south and is of a loamy, not clayey, soil, it will answer the purpose very well. If the land is near a hen-yard, it is well to fence the garden or to see that the hens are kept out of it.

Staking out

With small pieces of wood stake out the garden according to your plan. If you wish to see clearly how large the garden will be, run a string from stake to stake. These stakes, which are only temporary, will serve to show where to spread manure, where to plow, harrow, and do other work.

Manuring

If well-rotted stable manure is available, spread a plentiful coating of it over the garden. Some of the best gardeners use as much as 3 or 4 inches of well-rotted manure, spread all over their land, and the results are satisfactory. In fact, the majority of gardeners have come to the conclusion that, in comparison with other fertilizers, nothing else will produce plants in so fine a condition as plenty of manure well mixed with the soil.

Plowing

The ground should be plowed six to eight inches deep after the manure is spread. If a plow is not available, a spade or spading fork can be used. The two last-named tools are the best for satisfactory results, as they can be used to a greater depth than can a plow; and if these tools are employed by a man who will use his head as well as his hands in the work, the manure will be placed at such a depth and mixed with the soil in such a way as will be of the greatest value.

Smoothing

Harrowing can follow plowing, and fine smoothing can come afterward. Where horse power is not used the hand rake will be the next tool to utilize. The rake can be used for breaking lumps as well as for rendering

*Lesson 30 of the Cornell Reading-Course for the Farm, Vegetable-Gardening Series No. 1, gives necessary details as to hotbed construction and management. For this bulletin address the Cornell Reading-Course for the Farm, New York State College of Agriculture, Ithaca, New York.

the soil level and smooth. If horse power is used the hand-raking may be resorted to for complete smoothing; or, if the garden is exceptionally large, the smoothing may be done by the use of some one of the manufactured tools drawn by horse power. It is important that the surface of the garden be left in the finest condition, so that no obstructions will be in the way of rapid planting and transplanting.

Permanent staking

After the smoothing is done, permanent stakes can be driven at the corners of the garden in place of the temporary stakes described above. The permanent stakes should be of some substantial material, such as 2-by-4-inch scantlings. A nail should be driven in the top of the southeast corner stake, exact measurements from that nail to the stakes north and west should be made and nails placed in the tops of those stakes, and from these nails measurements should be made in order to determine the position of the nail in the northwest stake. The nail system helps greatly in future exact measurements for planting; with exact measurements from the nails, the rows can be made quite straight and parallel to one another.

PLANTING

The time of planting is given in the planting-table. That table, however, must be modified so as to suit conditions of weather and other factors of the great outdoors; it is meant to serve merely as a guide. In planting the seed, a row in the garden should correspond to a row as planned on the paper. Measurements from the stake should be taken at both ends of a row. A garden line or some other means should be used for keeping rows straight. The seed should be planted according to the table. A furrow should be opened to the required depth with a hoe, which, as has been said, should be guided by a line or mark. The seed should then be spread along the bottom of the furrow, and dirt should be filled in over the seed and pressed down by the feet.

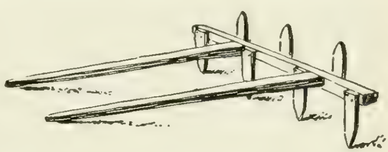

FIG. 32.—*A convenient tool for marking furrows*

FIG. 33.—*A dibble, useful in planting or transplanting*

The matter of pressure around seeds is very important because an aid to the first step in germination is the swelling of the seed by the water that it absorbs. The pressing of the soil increases absorption of water from the soil by the seed. Pressing on clay soil, however, may be overdone. If a planting machine is on the farm or in the home it may be used with very good results

for such planting as has been described. Planting machines open the furrow, drop the seed, cover the seed with soil, press the soil lightly on the seed, and mark the next row for planting. They are of great assistance in good gardening.

TRANSPLANTING

If tomatoes or other plants are raised elsewhere than in the garden — as in a hotbed, cold-frame, or seed bed — they should be removed from these places with the largest amount of root surface possible and transplanted to the garden, being placed at the proper distance apart in the row. With a trowel, dig a hole larger than the plant roots need; in this hole set the roots, slightly deeper than they grew; place dirt on roots; press hard; place other dirt on the roots, pressing now and then until the level of the soil is reached. The plant will thus have been transplanted in such a way as to have the best opportunity for successful growth. The pressing firms the soil about the roots and aids them in their growth, so that they may take water from the soil and pass it on to the leaves.

LATER CARE

Thinning

If plants come up too thickly, they should be thinned in accordance with the column headed "Distance apart of plants in row," in the planting-table. Such thinning is necessary in order to give the remaining plants the space needed for their best development.

Cultivating

Two conditions are necessary for proper cultivation: first, there should be no weeds; second, the surface soil should be loose at all times. The two conditions can be easily maintained by means of the hand, the hoe, and the rake. Pull out weeds by the hand, hoe around plants, and rake after hoeing. A wheel hoe is very desirable. It is a profitable investment and aids greatly in the work of cultivation. Where rows are far apart, so that horse cultivation is permitted, the work can be done with an eleven-tooth one-horse harrow. The horse work, however, rather increases the amount of hand work, as with horse tools it is not possible to cultivate so close to the plants as it is with hand tools, and the space remaining uncultivated by horse power must be gone over by hand.

Watering

If the season is exceptionally dry, it may be necessary to supply water in order to insure good growth. Hose, watering-can, or pails are useful, but good cultivation from the beginning is the most important factor in maintaining the water supply. At transplanting time it is often possible to help the plant obtain a foothold in its new home by an application of

water, about a pint to each plant; if the season is unusually dry, one or two later applications are very helpful.

WINTER STORAGE

A good outside pit or cellar for the storage of roots and other crops is of great use on the farm. The cellar should have room enough to accommodate all the vegetables needed or raised for the winter. It should have good ventilation, also, and should be built so that the vegetables will never be in danger of freezing. An outside cellar is more desirable

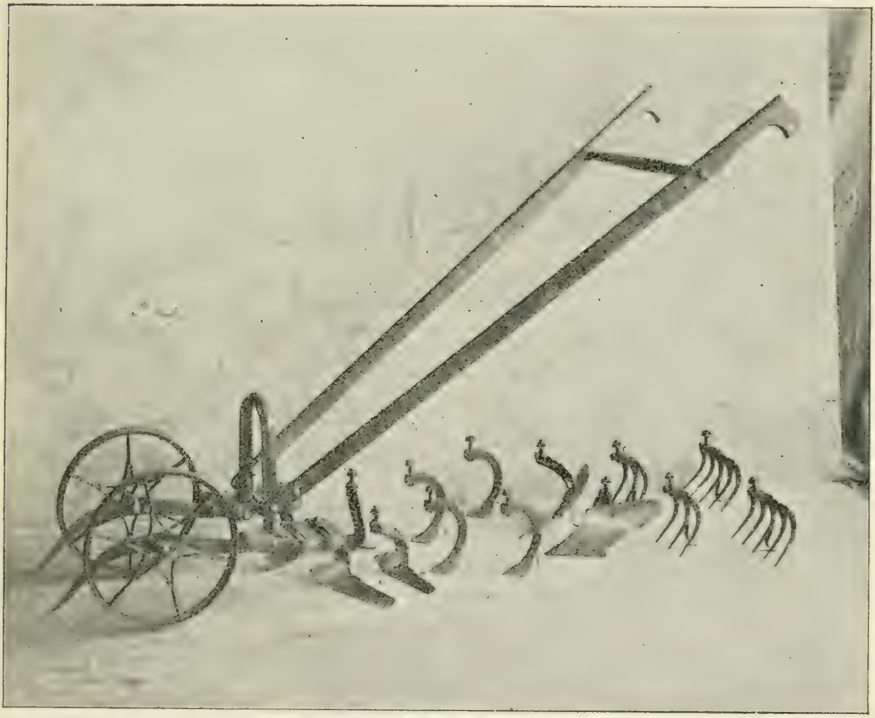

FIG. 34.—*Wheel cultivator and attachments*

than the house cellar, because the latter does not provide proper ventilation for successful storage nor is it a healthful place for such a purpose. If time is pressing or cellar space is limited, the root crops and cabbages may be stored in the field: straw being laid on the ground, the crops piled in on the straw, more straw added, and, as the piles are generally conical in form, dirt applied over the straw. Other rubbish and dirt may be added as the weather grows colder. Some work is necessary, however, to dig out the stored vegetables after the layers of dirt have been frozen solid.*

* For further information on storage, the reader is referred to Lesson 21 of the Cornell Reading-Course for the Farm Home.

Name of vegetable	Seed for 100 ft.	Time to plant seeds			Depth to plant seed (inches)	Time to transplant	Distance apart of rows		Distance apart of plants in rows	Ready for use after planting
		Hot-beds	Cold-frames	Open ground			Horse culture	Hand culture		
Artichokes, globe	1 oz.	March	April	May	½	May	3 to 4 ft.	2 to 3 ft.	2 to 3 ft.	15 months
Asparagus	60 to 80 plants			April or May		April or May	3 to 5 ft.	12 to 24 in.	12 in.	2 to 3 years
Beans, dwarf	1 pt.	March	April	May to July	1	June	30 to 36 in.	18 to 24 in.	3 to 4 in.	45 to 65 days
Beans, pole	½ pt.	March	April	May or June	1	June	3 to 4 ft.	2 to 3 ft.	3 to 4 in.	50 to 80 days
Beets	2 oz.	March	April	May to Aug.	½ to 1	May	24 to 36 in.	12 to 18 in.	4 to 6 to foot	60 to 85 days
Brussels sprouts	¼ oz.	March	April	May, June	½	May, June	30 to 36 in.	18 to 24 in.	12 to 18 in.	95 to 120 days
Cabbage, early	¼ oz.	March		April, May	½	April, May	30 to 36 in.	18 to 24 in.	12 to 18 in.	90 to 100 days
Cabbage, mid-season	¼ oz.		April	May	½	May, June	30 to 36 in.	24 to 30 in.	16 to 24 in.	100 to 120 days
Cabbage, late	¼ oz.		May	June	½	June, July	36 to 42 in.	30 to 36 in.	20 to 30 in.	100 to 130 days
Carrots	1 oz.	March	April	May, June	¼ to ½		24 to 30 in.	12 in.	2 to 3 in.	75 to 110 days
Cauliflower	¼ oz.	April	May	May, June	½	May, June	30 to 36 in.	18 to 24 in.	14 to 18 in.	100 to 130 days
Celery, early	¼ oz.	March		April	¼ or less	April	3 to 6 ft.	18 to 24 in.	3 to 5 in.	120 to 130 days
Celery, late	¼ oz.		April	May	¼ or less	May, June	4 to 6 ft.	24 to 42 in.	4 to 8 in.	130 to 150 days
Corn, early	¼ pt.	April	April	May	1 to 1½	May	30 to 36 in.	18 to 24 in.	Hills 18 to 24 in.	65 to 90 days
Corn, late	¼ pt.			May, June	1 to 1½		36 to 42 in.	30 to 36 in.	Hills 30 to 36 in.	75 to 100 days
Cucumbers	½ oz.	March	April	May, June	½ to 1	May	4 to 6 ft.	4 ft.	Hills 4 ft.	60 to 80 days
Dandelion	¼ oz.		April to Aug.	May	½		24 to 30 in.	12 to 18 in.	12 to 18 in.	6 to 12 months
Endive	1 oz.	March	April	June to Aug.	½	April	24 to 30 in.	12 to 18 in.	12 to 18 in.	90 to 130 days
Kale	¼ oz.		April	June to Aug.	½	May	24 to 30 in.	18 in.	18 in.	90 to 120 days
Kohl-rabi	¼ oz.	April	April	May to July	½	May	30 to 36 in.	12 in.	12 to 18 in.	60 to 80 days
Leek	½ oz.	April	May	May, June	½	May, June	24 to 30 in.	6 to 12 in.	4 to 8 in.	120 to 180 days
Lettuce	½ oz.	March	Apr. on.	April to Aug.	½	May on	24 to 30 in.	10 to 12 in.	Head 10 in.	60 to 90 days
Muskmelons	½ oz.	April	April	May, June	½ to 1	May	6 to 8 ft.	6 ft.	Hills 6 ft.	120 to 150 days
Onions	1 oz.	March	April	April, May	½	April, May	24 to 30 in.	1 ft.	2 in.	130 to 150 days
Parsley	¼ oz.	March	March	April, May	¼ to ½	April, May	24 to 30 in.	12 to 18 in.	3 to 6 in.	90 to 120 days
Parsnips	½ oz.		April	April, May	¼ to ½		30 to 36 in.	12 to 18 in.	3 to 4 in.	125 to 160 days
Peas, early	1 qt.		April	April	1 to 2		3 to 4 ft.	18 to 24 in.	Close	40 to 80 days
Peas, late	1 qt.			May, June	1 to 2		4 to 5 ft.	24 to 36 in.	Close	65 to 90 days
Peppers	⅛ oz.	March	April	June	½	May, June	30 to 36 in.	12 to 18 in.	15 to 18 in.	100 to 140 days
Potatoes, early	5 to 8 lbs.		April	April	3 to 5		30 to 36 in.	24 to 30 in.	12 to 14 in.	80 to 100 days
Potatoes, late	5 to 8 lbs.			May, June	3 to 5		36 to 42 in.	30 to 36 in.	12 to 18 in.	100 to 140 days
Pumpkins	½ oz.		April	May, June	1 to 1½		8 to 12 ft.	8 ft.	Hills 8 ft.	100 to 140 days
Radishes	1 oz.	March	April	April to Sept.	½		24 to 30 in.	8 to 12 in.	1 in.	20 to 40 days
Salsify	1 oz.		April	May	½ to 1		30 to 36 in.	12 to 18 in.	4 to 6 in.	120 to 180 days
Spinach	1 oz.	March	April	April, May, August	½		30 to 36 in.	12 to 18 in.	3 to 4 in.	30 to 60 days
Squash	½ oz.	April	April	May, June	1 to 1½	May, June	3 to 10 ft.	3 to 8 ft.	Hills 3 to 8 ft.	Bush 60 to 80 days, running 120 to 160 days
Tomatoes	⅛ oz.	March	April	June	¼ to ½	June, July	3 to 5 ft.	18 to 36 in.	1½ to 3 ft.	100 to 140 days
Turnips	½ oz.	March	April	April to Aug.	½	April, May	30 to 36 in.	12 to 18 in.	6 to 10 in.	60 to 80 days
Watermelons	1 oz.		April	May, June	1 to 1½	May	8 to 12 ft.	8 ft.	Hills 8 ft.	100 to 120 days

CULTURAL METHODS

The varieties recommended under the various kinds of vegetables are those that have been found by the writer to give the best satisfaction. Other varieties may be better suited to particular soils or climatic conditions.

Artichokes, globe

A deep, rich sandy loam, liberally supplied with well-rotted manure, seems best for artichokes. Plant the seed early in the spring, about ½ inch deep, in rows 2 to 3 feet apart for hand culture or 3 to 4 feet apart for horse culture. When the seedlings have come up they can be thinned so that they stand 2 to 3 feet apart in the row. The plants do not produce until the second season; they should therefore be covered during the winter. After the bed has once been obtained, the plants may be propagated by using side shoots from the base of the old plants. The burs will be larger if the plants are treated in this way than they will be by any other method. Clean culture should be given throughout the season. As the head, or bur, is the edible part, the artichoke should be gathered soon after blossoming and should not be allowed to produce seeds. If so gathered, the plant will continue to produce burs until the end of the season.

Asparagus

Asparagus will do well in almost any soil; but a well-drained sandy or gravelly loam, deep and mellow, seems to suit it best. It may be started by planting seeds and growing the seedlings one year, the seeds being planted in rows 1 foot apart and about ¾ to 1 inch deep. The seedlings should be thinned so as to stand 8 or 10 inches apart and liberal applications of manure should be made. If the time required for starting the seedlings is too valuable to be given to this work, growing roots may be bought at $8 to $12 a thousand or a relatively larger figure for smaller amounts — $4 for a hundred roots. These roots or the roots that are home-grown may be planted in rows 1 to 5 feet apart, with 12 inches between plants in the row. The roots should be placed in a trench at least 8 inches deep; one of the best practices is to dig the trench 4 or 5 inches deeper and fill it with well-rotted manure, with an inch of dirt over the manure. The plants are then set on the dirt, the crown of the plants being placed slightly higher than the roots. Soil to a depth of 1 to 1½ inch is then tramped down on the roots. The stalks are not used the first or the second year, but cutting may begin with the third year. At that period the trenches are filled nearly level, as surface tillage to keep the garden under clean culture causes some of the dirt to fall into the trench. As this plant is a heavy feeder, liberal applications of manure should be made every winter or spring. In harvesting, the stalks are cut below the ground

with a knife, such as an ordinary butcher knife or an asparagus knife. The stalk obtained is generally 3 or 4 inches of green growth above ground, with a so-called "cat's paw" on the end, and 4 to 5 inches of whitish stalk that has grown below ground. The stalks should not be cut after July 1.

The best varieties of asparagus are Giant Argenteuil, Palmetto, Conover's Colossal.

Beans

Beans thrive best on a warm sandy loam. Soils rich in nitrogen are not best suited to the profitable growing of beans, owing to the fact that plants grown on such soil will have a tendency to produce too much leaf and stem growth at the expense of the crop of pods. Beans are well suited for rotation with other garden vegetables, as they do not exhaust the soil of plant food. Beans in heavy clay do not give satisfaction; after a rain the soil forms a crust that may prevent the seedlings from coming up evenly, and the little leaves containing the stored food for the development of the plant are likely to be torn from the stem in being pushed through the crust. Beans are tender plants and will not stand frost; therefore the seed should not be planted too early in the spring.

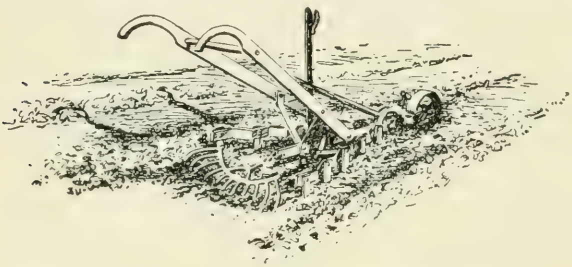

FIG. 35.—*A type of garden cultivator*

Beans may be divided into two classes: bush beans, or those having a bush-like growth; and pole beans, or those that require support. Bush beans may be planted in rows 18 inches apart where hand tilling is given. The seed should be covered not more than 1 inch deep, and less if the soil is very wet. The plants should be 3 to 4 inches apart in the row. They may, however, be planted in hills, that is, with three to five seeds clustered together every 12 to 15 inches in the row. Frequent shallow stirring of the soil is required; this destroys all weeds and maintains a loose soil surface and a mulch to conserve the moisture in the soil. Pole beans are generally grown in hills around a pole, receiving their name from this method of planting. They may be grown, however, in rows on a trellis. Pole beans are climbing beans and should be thinned so that they have sufficient space to produce the maximum crop. Their requirements are similar to those of bush beans.

Beans should be picked only when the bunches of pods are dry; if the picking is done when the plants are wet, diseases may set in, making the future pods undesirable.

Varieties of beans recommended are:

Bush, Wax: Wardwell's Kidney, Refugee, Golden, Black.

Green snap: Giant Stringless Green-Pod Valentine, Dwarf Horticultural, Mohawk, Bountiful, Refugee.

Shell: Dwarf Horticultural, Red Kidney, White Kidney, Yellow Eye.

Lima: Henderson's, Fordhook.

Pole, Green-podded: Horticultural, or Speckled Cranberry; Kentucky Wonder, or Old Homestead; Lazy Wife, Case Knife, Red Cranberry.

Wax-podded: Golden Butter, Black.

Lima: White, Challenge, King of Garden, Sieva.

Beets

The garden beet may be grown in any good soil, but rich sandy loam will give the best results. Sow the seeds in drills, 1 to 3 feet apart and not deeper than 1 inch. When the plants are 3 to 5 inches tall they should be thinned so that there are four to six plants to every foot of row. Beet thinnings make very good greens. As a rule, each so-called seed contains more than one real seed; this may account for beets' coming up so thickly sometimes. Beets for winter storage should not be sown until the latter half of July. Culture should be given rather frequently. As the beet is a surface feeder, only shallow cultivation should be the practice. The beet is harvested by being pulled out of the ground, the leaves being topped and a small part of the leaf stem being left on the beet. The beets are then thrown into piles and stored in the field by the method previously described, or in the storehouse. If placed in the storehouse they should be covered with soil in order to prevent their drying out.

Perhaps one of the best beets for cold-frame and early work is Crosby Egyptian. Eclipse is the best hotbed, or extremely early, beet. For the main season choose Edmands. For a very dark blood-red beet Detroit is good. For table use beets should not be very large; a diameter of $1\frac{1}{2}$ to $2\frac{1}{2}$ inches is quite enough. For the canneries even smaller sizes are in demand.

Brussels sprouts

Brussels sprouts may be grown from seed in the hotbed or cold-frame and transplanted directly to the garden, generally about the first of May. The rows should be 18 to 36 inches apart and the plants in the row 12 to 18 inches apart. Clean culture should be the practice.

The little heads grow along the stalk at the base of each leaf petiole. When the heads are about $\frac{3}{4}$ inch in diameter and quite hard they are ready

for harvesting. There are two methods of harvesting them: some growers prefer to cut them from the stalk, while others assert that breaking them from the stalk is the better practice. Brussels sprouts have a more delicate flavor when cooked than has cabbage, and they are generally quoted at a higher price than any other of the cole crops.

FIG. 36.—*On the left is a spindling plant, set deep. On the right is a plant, cut back*

The best variety of brussels sprouts is the Improved Paris Market. There are some localities, notably Long Island, where special strains are grown, such as the Pineapple-Shaped — a low-growing, heavy-producing strain.

Cabbage

There are three distinct seasons when cabbage may be matured. Early cabbage, as Early Jersey Wakefield and Early Erfurt, is produced in June and July; such varieties as All Seasons, Early Summer, and Copenhagen Market are produced during July, August, and September; late varieties, as Danish Ball Head, Marblehead Mammoth, Red Dutch, Savoy, and Stone-Mason, are produced late in the fall. The planting time varies, therefore, for each of the three classes; early varieties being forced in hotbeds, mid-season varieties grown in cold-frames, and later varieties grown in prepared seed beds or where they will stand in the row. The distances between the rows and between the plants in the rows also vary somewhat, and can be ascertained from the planting-table. Clean culture is the practice with all the classes of cabbage.

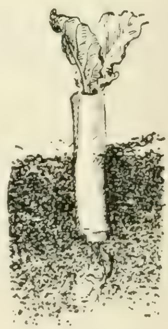

FIG. 37.—*A wrapper of paper prevents injury from cutworms*

In harvesting cabbage, the usual method is to slightly break down the leaves on one side and insert a knife across the stock, or stem, thus removing the head from the leaves. If the cabbage is to be placed in cold-storage, this is the proper method of harvesting; otherwise the plant is harvested entire, with leaves and stem.

There are several methods of storing cabbages. They may be placed in ordinary cold-storage, or stored in cellars, in rooms, or in the field, each method having its advantages. One of the

best storage places for the home grower to use is the hotbed after the manure and soil have been removed. If the hotbed is covered with litter the cabbages will keep in good condition, provided ventilation is given.

If the cabbages in the field are infested with worms, the worms may be controlled somewhat at first by paris green. If they come on later, when the cabbage heads are forming, it is best to use a 10-per-cent salt solution in water, hellebore powders, or pyrethrum powders. Do not use any strong poison when the heads are forming.

Cabbage is subject to some diseases. However, if the plants are grown properly and given the best cultural methods, they have a tendency to resist disease.

Carrots

The best carrots are grown on a sandy loam. The seed is sown rather thickly, in drills, or rows, 12 to 30 inches apart, in May or June. The seed is covered about $\frac{1}{2}$ inch deep. Sometimes radish seeds are planted with the carrots in order to mark the row for the carrot and to help break the soil for the weaker plant. When the plants are 4 or 5 inches tall they are thinned so that 2 to 3 inches of space is given between the plants in the row. For the best results, shallow clean culture must be given throughout the season.

Carrots may be pulled and used when very small; or they may be allowed to mature fully and be pulled in the fall, the leaves being cut from them and storage furnished according to one of the methods described.

In storing carrots the important point is to prevent their drying out; they must be kept in moist soil, yet have good ventilation.

The varieties of carrots recommended are Chantenay, which is a half-long variety, Half-Long Danvers and Long Danvers, Oxheart, and, for extremely early forcing, Early Scarlet Forcing.

Cauliflower

Cauliflower is grown much as is cabbage, generally being transplanted from hotbeds, cold-frames, or seed beds. It requires less space for growth than does cabbage, but needs more attention when the heads are forming. As soon as the small, coral-like flower is seen, the leaves should be clustered over the top in order to prevent entrance of light to the flower.

Clean culture must be given throughout the season, as well as treatment for insects and diseases, as prescribed for cabbages.

When the flower has come to a diameter of 6 inches it is ready to harvest. It may be left longer, but at the stage mentioned it is in the best condition. In harvesting cauliflower, the knife is inserted about 3 or 4

inches below the flower, and some of the leaves are taken with the head. The leaves are then trimmed so that their tops are at the widest part of the flower, making a pretty vegetable with a pure white, coral-like center and a fringe of light green around the outside.

Early varieties are Early Snowball and Erfurt; later varieties are Dwarf Danish and Autumn Giant. Snowball can be used for all purposes, and is the variety most widely grown.

Celery

Celery seed is so exceedingly small that it should not be planted very deep; one fourth of an inch or less is the best depth. Early celery is strictly a hotbed crop, being transplanted later to cold-frames and then to the field. It should be given the best of cultivation, and quantities of high-grade fertilizer or manure should be applied to the soil. Celery requires a large amount of water for its best development, and should never be subjected to drought. Later celery is planted in the seed bed and transplanted once. The same conditions are provided for late as for early celery up to the time of blanching. At blanching time early celery has a covering of boards at each side, which may be 8 to 12 inches high. Dirt, paper, or any material that will shut out sunlight so that the stalks will blanch, may be used instead of boards. The tops of the boards or the dirt should be as near together as possible, so that the plants will become whitish. With late celery the common practice is dirt-blanching, making the dirt covering higher as the plant grows.

In harvesting celery, the best method is to run a knife an inch or two under the ground and cut the root. The root is then trimmed further and the outside course of leaves is removed from the celery. Late celery is generally taken up with its roots attached, and stored.

Celery may be stored in the field or in the home garden, or the bottom of the hotbeds may be used for storage; the roots being buried in sand and the plants standing close together. Ventilation must be given, as well as freedom from outside moisture and cold. Celery stored by proper methods in empty hotbeds can be kept throughout the coldest winter.

The variety of celery recommended for early plants is Golden Self-Blanching, which seems to outrank all others. For winter, also, Golden Self-Blanching is used to a large extent, and Boston Market, Winter Queen, and Giant Pascal are highly recommended. Winter Queen is a celery that blanches out to a very beautiful color and has a noticeably nutty, crisp quality.

Corn, sweet

Sweet corn should be planted on fairly rich land; a good loamy soil will give satisfaction. Plant the seed in rows 18 to 42 inches apart, five

or six seeds being planted in a so-called "hill" 18 to 36 inches apart in the row. Later, thin so that but three strong stalks remain in each hill. The seed should be planted not deeper than 1½ inch; one inch is even better. Clean culture should be given at all times. Corn roots are relatively surface feeders, therefore only shallow cultivation should be practiced. Remove the sucker growths that come out from around the base of the stalk, as they have a tendency to decrease the productiveness of the plant.

There are a number of good varieties of corn. For early use, Early Cory, Crosby, and Minnesota are recommended; for the main season, Golden Bantam, Carpenter's Golden, Black Mexican, Quincy Market, Potter's Excelsior; for late use, Country Gentleman, Stowell's Evergreen, Late Mammoth Sugar.

Cucumbers

A rather rich, moist — but not wet — sandy loam is the best soil for cucumbers. The seed should be planted about ½ inch deep — certainly not more than 1 inch — in hills 4 feet apart each way. Do not plant until all danger of frost is past. A shovelful of well-rotted manure or a small handful of fertilizer thoroughly worked into the soil under each hill, in addition to the general manuring of the land, will promote the best results. The additional manure will give the plant an especially good start and make it very vigorous and healthy. Cucumbers may be planted also in drills, or rows, 6 inches apart, the plants being thinned to 12 inches apart in the row. Cucumber seedlings are very easily injured by cold, even if no frost occurs· therefore the planting should be put off until the soil is warm.

A small yellow-and-black striped beetle attacks the lower part of the stem of the cucumber or the underside of the leaves, often destroying great numbers of young plants. Where only a few hills are grown, the attacks of this beetle may be prevented by covering the plants with a box that has fly-screening or mosquito-netting nailed over its top. Later the box is removed and put away for the following year. For a larger patch, air-slaked lime or wood ashes acts as a distasteful food to the beetles, or poisons properly applied are useful in removing the pest. As cucumber diseases are now common, bordeaux mixture may have to be applied several times in order to protect the plant. A vigorous, thrifty plant is, however, more or less an insurance in itself against disease, especially if the plant is grown early in the season.

Cucumbers require frequent shallow cultivation until the vines spread over the ground. Afterward, pulling out the stray weeds seems to be the only culture needed. If it is desired to keep the vines in good bearing condition, no fruit should be allowed to ripen on them.

In harvesting cucumbers, cut the short stem so that $\frac{1}{4}$ to $\frac{1}{2}$ inch of stem remains on the cucumber. The cucumbers will keep longer and sell better if this suggestion is followed.

Varieties of cucumbers recommended are: for slicing, Improved White Spine, Davis Improved, Cool and Crisp, Fordhook; for pickles, Boston Pickling, White Spine, Fordhook.

Dandelions

Sow the seed of dandelions in the spring, about $\frac{1}{2}$ inch deep, in drills 12 to 30 inches apart. When the plants have made growth enough to be recognized they should be thinned to about 12 inches apart. The thinning should be followed by very clean culture during the summer. If in a cold part of the State it may be desirable to mulch slightly during the winter in order to prevent heaving of the plants resulting from the honeycombing of the ground by the action of frost. The plants will be ready for consumption the next spring in a green stage; but they are greatly improved if blanched by setting two boards in the form of an inverted letter V over the row. Such blanching lessens the bitter taste of the plant and makes the leaves very tender.

Varieties of dandelions that are recommended are American Improved and Thick-Leaved French.

Endive

A sandy loam fairly well supplied with humus or manure is a desirable soil for the production of endive. The seeds are sown rather thickly in drills, about $\frac{1}{2}$ inch deep, the drills being 12 to 30 inches apart and the plants being later thinned to 12 to 18 inches apart in the row. Endive should have continuous growth throughout its season in order that a good growth of leaves may be obtained. When the leaves are 8 to 10 inches in length they should be drawn together and tied at the top, or a V-board, such as is mentioned under "Dandelions," may be used for the blanching. The leaves should not be tied when they are wet, as moisture decays the head. After a short period the plants will lose their green color and become of a light, creamy color. At that time they should be used.

Varieties of endive are Broad Leaf, Green Curled, White Curled. Among a certain class this vegetable is considered a great delicacy.

Kale

Kale may be started as is cabbage, by planting in hotbeds and later transplanting; or it may be started in cold-frames and transplanted. The rows should be 18 to 30 inches apart and the plants 18 inches apart

in the row. The cultivation required is similar to that for cabbage. The plant is very hardy and will live during the winter in open ground in localities where very severe freezing does not take place. Where the kale is grown under such conditions that light frosts are allowed to strike it, the flavor is greatly improved. It is used as a substitute for cabbage or as a green.

The variety of kale recommended is Green Curled Scotch. That variety does not form a head, but has thick leaf stems and curly leaves.

Kohl-rabi

Kohl-rabi belongs to the same class of plants as do cabbage and cauliflower, and is grown as they are. This is an intermediate vegetable between cabbage and turnip, the edible part being the swollen stem of the plant, which comes just above the ground. Kohl-rabi, however, can be planted closer than can cabbage. Plants 12 inches apart each way will yield very good results. The fleshy stems should be used when they are young; continued growth to a large size results in woodiness, which is not a desirable property.

The two varieties that are considered the best are White Vienna and Purple Vienna.

Leek

The leek belongs to the onion family. It may be sown very early in the spring in the hotbed or cold-frame, and later transplanted to the field. The rows may be 6 to 30 inches apart, according to the method of culture, the plants being 4 to 8 inches apart in the row. As the edible part is the bulb and a part of the stem, leek plants when set out should be set very deep. They do their best on a sandy-loam soil that has in it a considerable amount of humus. In many gardens leeks are grown in trenches. As they increase in size the dirt is drawn around their stems and bases, the result being leeks that have 4 to 6 inches of blanched stem and bulb.

Leeks are marketed in bunches, as are young onions, and may be stored during the winter as is celery.

The varieties of leek recommended are Flag and Carentan.

Lettuce

Most varieties of lettuce thrive best during early spring or late autumn. The cos, or summer lettuce, however, is an exception. A rich sandy loam, full of organic matter such as rotten stable manure, is the soil for the best development of lettuce. Plant the seed in rows 10 to 30 inches apart, and thin the plants so that they stand 10 to 12 inches apart in the row. A setting of ½ inch deep in the soil is enough for the seed. In order

to produce crisp, choice lettuce, the plant must have continuous rapid or forced growth; this means plenty of water and cultivation.

In harvesting, cut the plant with a knife just below the place where the first leaves branch or start from the stem. Wash the dirt off the head by placing in a tub of water—stem end first, never the other way. Place in baskets or boxes, stem up. Lettuce is a good crop to use for companion or succession cropping. Extra choice, crisp lettuce is a delicacy.

The best varieties of lettuce for use in hotbeds are Hittinger's Arlington Forcing, Big Boston, Deacon, Grand Rapids, and Romaine, or Cos White Paris; and for outside use, the former varieties, except the first, in addition to Mignonette, Brown Dutch, and Salamander.

Muskmelons

A sandy loam with plenty of well-rotted barnyard manure, especially a shovelful placed in each hill, will give good results in melons. The melons may be started in berry-boxes or paper boxes in the hotbed or the cold-frame, and later transplanted to the field. The rows should be 6 to 8 feet apart and the hills should be 6 feet apart in the row. If there are six or eight or more seeds planted at first, they may be thinned later to four of the best plants. Muskmelons may be grown in drills as are cucumbers, and their cultivation should be maintained until it interferes with the proper growth of the vines.

Varieties of muskmelons recommended are Netted Gem, Osage, Nutmeg, Hackensack, Miller Cream.

Onions

Plenty of humus well mixed into a rich sandy loam is a good soil for the production of onions. The crop has been grown successfully on the muck lands of New York State. The seeds are planted in rows, or drills, 12 to 30 inches apart, the seed not deeper than $\frac{1}{2}$ to $\frac{3}{4}$ inch. On sandy land the onions are later thinned to four or five plants for each foot of row. On muck soil, *do not thin*. For very large or very early onions it is an advantage to plant the seed in hotbeds, transplanting to the rows in the field when the onion seedlings are 6 to 8 inches high, being sure to have a large number of roots attached to each seedling. Onions require frequent shallow cultivation, with persistent attention to clean culture as to weeds. Such culture is oftentimes obtained only by hand-weeding.

In early fall the tops of the onions should droop over and die. At that time pull the onions, allow them to cure for a short period by lying on the ground, then cut off the dead tops and store the bulbs in crates in a well-ventilated place.

Onion sets (small onions) may be planted instead of the above-mentioned seedlings, and in the same way; or onions may be used as a short-season crop with some other vegetable such as the tomato.

There are several kinds of onions, such as the Multiplier, or Potato, onion; the Top, or Tree, onion; and Shallots, Cibol, and so on — all of which are useful in the farm garden. Desirable common varieties are Yellow Globe Danvers, Southport Yellow Globe, Southport Red Globe, Large Red Wethersfield, White Queen, and Prizetaker, the last-named being especially good for hotbed use.

Parsley

Parsley may be started in greenhouse, hotbed, or cold-frame, and later transplanted to open ground in rows 12 to 30 inches apart, the plants 3 to 6 inches apart in the row; or the seed may be sown in rows and the seedlings thinned to the proper distance. A good garden soil gives the best results. Parsley is very hardy and will live over winter in good garden soil if properly covered. It cannot well withstand the great heat of summer, therefore a shady location is desirable for it.

The parsley roots may be lifted in winter and placed in a cold-frame or in a deep box in the house, and parsley can be obtained from them until they become exhausted during the winter.

Parsley is much used for flavoring soups and for decorative table purposes, especially as a garnish for meats.

Varieties of parsley recommended are Green Crest and Moss Curled.

Parsnips

The parsnip requires a rich loamy soil for its best development; one that has a deep loam is preferable, so that the long root of the parsnip can develop fully. Plant the seed about ½ inch deep in rows 12 to 36 inches apart. Radishes planted with this seed help to break the surface soil and serve to mark the rows. Thin the plants so that three or four remain for each foot of row. Good clean culture is necessary for the best results with this plant.

The parsnip roots may be dug late in the fall and stored for winter use, but freezing in the soil improves their flavor. The parsnip may be left all winter in the ground, being dug in the spring for use.

Varieties recommended are Hollow Crown and Long Smooth White.

Peas

A rich loose or friable soil that has good drainage is well adapted for the growing of early garden peas in the spring. It is not necessary to

apply fertilizers that are rich in nitrogen; if the ground is given a good coating of manure — such as is described on page 1398 — that will be enough fertilization for the growth of a good crop of peas. Peas are generally planted close together, in drills, the drills being 18 inches to 4 feet or more apart according to the method of culture. The seed in the drills may be 1 to 2 inches deep. If the seeds are planted in drills at a greater depth than 2 inches, they should be covered only an inch deep at first; as they come above the ground the dirt can be drawn to them. It has been found advisable not to depend too much on the taller peas, as the expense and trouble of bushing is a considerable item; the dwarf, or bush, peas give, in a great many cases, as good results as do taller-growing peas. Good cultivation should be practiced throughout the season.

Peas should be harvested when their pods are full, or rounding. They should be taken from the vines with the least injury to the vines themselves. After the pea crop is harvested the vines may be turned under or removed, and a crop of either beets or turnips may take the place of the peas.

The best early variety of peas is Alaska; for mid-season varieties, Excelsior, Gradus, Thomas Laxton, McLean's, Admiral Dewey, and others; for a later variety, Dwarf Champion, or Carter's Daisy. For the tall peas, Champion of England, Telephone, and Telegraph, if the grower has sufficient time to spend in bushing or trellising them.

Peppers

A good loamy soil, well manured, will produce good peppers. Plant the seed in a hotbed or cold-frame; later transplant the seedlings to the field in rows 12 to 36 inches apart, 15 inches being left between plants in the row. Give the best clean culture and dirt mulch. Peppers are easy to grow, but are relatively slow growers. They need warm weather and a long growing season.

Desirable varieties of peppers are Long Red Cayenne, Large Bell, or Bull Nose, Ruby King, Chinese Giant, Red Cherry.

Potatoes

The best soil for the round, or Irish, potato is a rich sandy loam in which a fertilizer containing a high percentage of potash has been used. Early potatoes, such as Early Rose and Early Northern, can be planted very early in the spring and protected through the growing season. Later potatoes, such as Carmen 3, Green Mountain, Gold Coin, and Irish Cobbler, may be planted later, after the danger of frost is past. Irish potatoes are generally planted in drills, or rows, 24 to 42 inches apart, the potatoes being dropped 12 to 18 inches apart in the rows. The depth for the planting of potatoes is 3 to 5 inches, the deeper planting being

preferred. If very early potatoes are desired the early kinds may be grown in a cold-frame, yielding a crop in May or June. Good culture should be given potatoes, and spraying seems to be necessary in order to obtain the best results.

On the late potatoes the vines should be allowed to die; their dying denotes that the cork layer is being formed on the exterior of the potatoes. Later the potatoes are dug and can be stored in the cellar. They might be stored in the field or in other places if freezing could be prevented. The early potatoes are generally dug before they have formed much of their cork layer. They must, therefore, be used very soon after they are dug.

FIG. 38.—*A drill machine*

Pumpkins

The pumpkin has been found to grow in almost every soil; but a good loamy soil, which has had a sufficient coating of manure mixed with it and a generous forkful of manure placed under each hill, will surely produce good pumpkins. Pumpkins, however, can be very easily grown in the field or with sweet corn. Plant four or five seeds in a hill, 8 feet from the next hill in the row and 8 to 12 feet from the hill in the next row. Later, thin to two or three plants to each hill.

Squash bugs may cause trouble. In this case place shingles on the ground near the plants; early in the morning the bugs will be under the shingles and can be destroyed. Allow only one pumpkin to a vine, for production of the largest size. A pailful of water now and then near the hill will be helpful, especially if the weather is not rainy.

Good varieties of pumpkins are Sweet Sugar and Quaker Pie.

Radishes

A quick, rich soil, such as a sandy loam full of rotten manure, is required by radishes. If they grow slowly they will have a sharp flavor and be tough and woody. For a continuous supply, plant every two weeks in rows

8 to 30 inches apart and thin plants to stand 1 inch apart or a little more. Radishes can be grown between slower-growing plants; in this way two crops may be obtained on the same land during the same year. Clean culture must be given.

For late summer radishes, plant Chartier, White Icicle, or some other large variety. For all-season growth, producing a very large radish, try Japanese Sakarijima. These varieties require more space for growth. Other good varieties may be classified as follows: Early: Scarlet Globe Turnip, French Breakfast, White Olive-Shaped. Summer: Strasburg, Chartier. Winter: California White, Black Spanish, Rose China.

Salsify

A gravelly loam or any good garden soil is satisfactory for salsify. Plant the seeds about ½ to 1 inch deep in rows 12 to 36 inches apart, and thin the seedlings to 4 to 6 inches between plants. Salsify seed resembles little sticks about half an inch long. The seedlings in coming up resemble onion seedlings but do not have the crooked tip, being divided into two or three parts. The cultivation for salsify should be frequent, thorough, and shallow. Salsify is a useful vegetable and one to be recommended. Its common name is " vegetable oyster," and it is said to have a noticeable oyster flavor.

In the late winter salsify may be dug as parsnips are, and its roots used or stored. They may be left in the ground through the winter, however, and dug before growth starts in the spring.

The variety of salsify recommended is Mammoth Sandwich Island.

Spinach

In order to produce good spinach, a rich loam that will give the plants a quick growth is required. Plant the seed not more than 1 inch deep in rows 12 to 36 inches apart. Thin the plants when 3 inches high to three or four plants to the foot. Give constant clean culture.

In gathering spinach the entire plant is removed, the largest plants being taken first.

Spinach can be used as a companion or succession crop to utilize waste ground in the garden.

Varieties that may be recommended are Giant Thick Leaf, Bloomsdale, Victoria.

Squash

A good loamy soil will meet the requirements for growing squash. Plant five or six seeds of a bush variety in hills 3 by 3 feet, using a good forkful of well-rotted manure under each hill. Stir the soil frequently at first; later the growth will take care of the soil, provided all weeds are

pulled out. For late squash, the hills are prepared as has been described, but are 8 by 8 feet instead of closer. Cultivation is necessary at first; or some other crop, such as spinach, radishes, or lettuce, may be grown on the space left at the beginning. Later the squash will cover the entire ground. When the squash plants, whether late or early, are 8 to 12 inches high, thin the hills to three plants. Only one late squash to a vine means larger and better squash than would otherwise be obtained.

The following varieties of squash are recommended: bush varieties, Crook Neck, White Scallop, Yellow Scallop, Golden Custard, Vegetable Marrow; running varieties, Delicious, Orange Marrow, Hubbard Warted, Warren, Faxon.

Tomatoes

Start the plants in the hotbed; transplant to the field when all danger from frost is past, in rows 1½ to 5 feet apart with the plants 1½ to 3 feet apart in the row. Train the vines to stakes, using one stout stake and two cross-arms or employing some other method. Cut back the vines if they grow too much to leaves and stalks. Sandy loam in good condition, with an application of manure plowed under, will produce good tomatoes. A little rotten manure on the soil near the plant, if sprinkled with about a pailful of water now and then after the fruit is set, will have a tendency to cause the fruit to be smooth and of good color.

Varieties of tomatoes recommended are Belmont, Chalk's Early Jewel, Stone, Earliana, Bonnie Best. For preserves, grow the following: Peach, Pear, Cherry, Strawberry, Plum.

Turnips

The turnip requires a rich soil, sandy or gravelly, and may be grown as either an early or a late crop. For the former, sow the seed in rows 12 to 36 inches apart early in the spring. Later, thin the plants to about six or seven to the foot. For late turnips the seed is sown in rows 12 to 36 inches apart, on land from which some earlier crop has been removed in June. Thin so that there are only two or three plants to each foot of space. Clean culture and a good soil mulch are required. Turnips are fairly hardy, easily withstanding the first light frosts in the fall.

Varieties of turnip recommended for early planting are Snowball, White Milan, Purple Top Milan; for late planting, White Egg, Budlong Rutabaga, American Rutabaga.

Watermelons

Soil that has a large percentage of sand is required for watermelons. Besides the manure already provided for the garden, an application of a shovelful of well-rotted manure to each hill, similar to that used for

cucumbers, is beneficial. Plant the seed 1 inch deep in hills 8 feet each way, five or six seeds in each hill. Thin later to three plants in each hill. Watermelons must be protected from the cucumber beetle until their foliage becomes toughened, according to the method described for cucumbers. Good cultivation should be maintained until the vines interfere with it. When the melon is ripe it has a hollow sound.

In harvesting cut the stem so that a small part of it will be left on the melon.

Desirable varieties of watermelons are Early Cole's, Vick's Early Sweetheart, Hungarian Honey, Gypsy.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 33 ITHACA, N. Y. FEBRUARY 1, 1913 GARDEN SERIES No. 1

VEGETABLE-GARDENING

DISCUSSION PAPER

This discussion paper may be returned with answers to the questions and with any suggestions and questions of your own. While the answering of these questions is not absolutely necessary, a much greater benefit will be derived if you give to others the benefit of your own experience. It will also help us to understand your point of view. The lesson may be used in the grange and in the club where these subjects are considered.

1. What part do vegetables play in the diet?

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

2. Describe your own vegetable garden: size; location; soil; kind of things grown; amount the garden yields.

3. How is your garden cultivated? What kind of tools do you find most useful?

4. How and where do you procure your seeds?

5. Do you recognize differences in the quality of peas, beans, and corn? What varieties are best for your planting?

6. Give any experience that you may have had with hotbeds.

7. What have been your chief difficulties in kitchen-gardening?

8. Give any instances that have come under your observation, in which kitchen gardens have added substantially to the revenue of the housewife.

Name..............................

Address............................

Date..............................

The Cornell Reading-Courses
LESSON FOR THE FARM HOME
L. H. BAILEY, *Director*
COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 35 | ITHACA, N. Y. MARCH 1, 1913 | GARDEN SERIES No. 2

THE FLOWER GARDEN

Introduction by

L. H. BAILEY

The main planting of any place should be of trees and shrubs. The flowers are then used as decorations. They may be thrown in freely about the borders of the place, not in beds in the center of the lawn.

FIG. 39.—*Rudbeckia. An attractive garden, with the child growing in it*

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They show off better when seen against a background; this background may be foliage, a building, a rock, or a fence.

Where to plant flowers is really more important than what to plant. In front of bushes, in the corner by the steps, against the foundation of the residence or outhouse, along a fence or a walk — these are places for flowers. A single poppy or petunia plant against a background of foliage is worth a dozen similar plants in the center of the lawn. In a cozy back yard the shrubs and trees should be the main features, and bright flowers the incidents. Too many flowers make a place over-gaudy. Too much paint may spoil the effect of a good building. The decoration of a yard, as of a house, should be dainty.

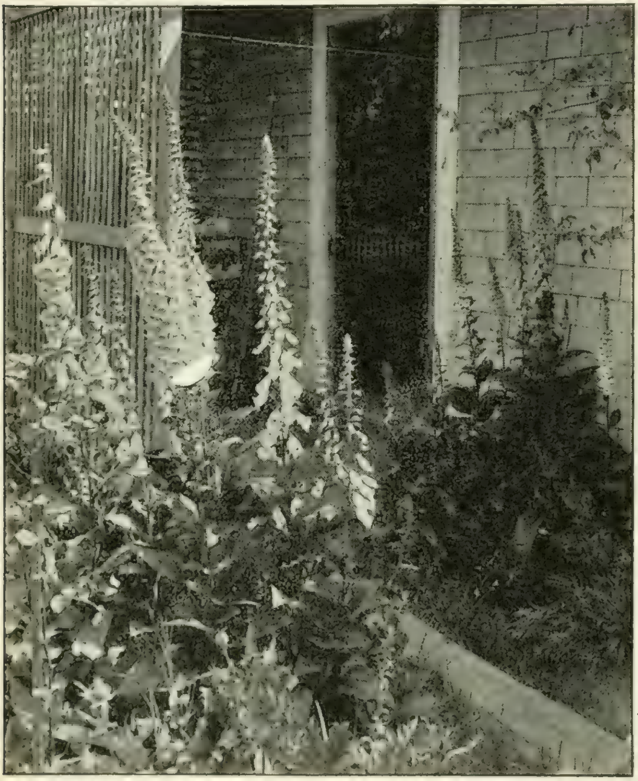

FIG. 40.— *Digitalis. A pleasant outlook*

The open-centered yard may be a picture: the promiscuously planted yard may be a nursery or a forest. A little color thrown in here and there puts the finish to the picture. A dash of color gives spirit and character to the brook or pond, to the ledge of rocks, to the old stump, or even to the pile of rubbish.

But the person may want a flower garden. Very well; that is a different matter. It is not primarily a question of decoration of the yard, but of growing flowers for flowers' sake. It is not the furnishing of a house, but the collecting of interesting and beautiful furniture. The flower garden, therefore, should be at one side of the residence or at the rear; for it is not allowable to spoil a good lawn even with flowers. The size

of the garden and the things to be grown in it must be determined by the desire of the person and the amount of time and land at her disposal; but a good small garden is much more satisfactory than a poor large garden. Prepare the land thoroughly, fertilize it, resolve to take care of it, choose the kind of plants you like; then go ahead.

Perennial herbs.— These are plants that live from year to year. Usually, however, they give their best bloom the second or third year, and then gradually weaken. Some kinds are of little value after the third year. For the main and more or less permanent effects in the flower garden, the perennials should be used. They come up every spring, even if one does not find time to spade and plant the garden. The earliest bloomers in spring are perennials, perhaps bulbous perennials. Every country flower garden should contain many of the so-called "old-fashioned" perennials, such as bleeding-heart, everlasting pea, hollyhock, foxglove, tiger lily, phlox, crown imperial, polyanthus, larkspur, forget-me-not, pink, sweet william, dusty miller, peony, blue flag, valerian.

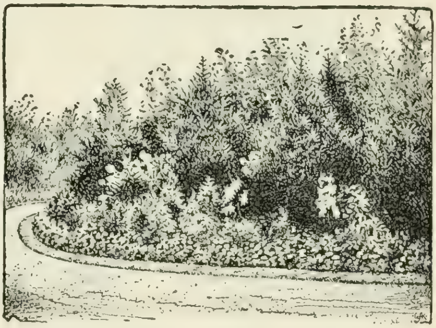

FIG. 41.—*A dainty border of flowers*

Many of the plants that one finds in the fields are very satisfactory when transferred to the garden. This is particularly true of asters and goldenrods. Of the great numbers of garden perennials, not mentioned above, the following are desirable for a home flower garden: irises, of many kinds; lilies; some kinds of lychnis; pyrethrums; wall-flowers; gaillardias; hardy chrysanthemums; poppies; California poppies (usually treated as annuals); some kinds of coreopsis; columbines, often erroneously called "honeysuckles"; double ranunculus; Japanese anemones, excellent for autumn; funkia and hemerocallis, both known as day lilies; herbaceous spireas; Golden Glow rudbeckia; yucca; Shasta daisy (this is hardy at Ithaca); various campanulas, or bluebells; snapdragon (it should be renewed every year or two); perennial candytuft, for spring bloom. The list could be greatly extended. Most of these can be grown readily from seed. They usually begin to bloom the second year. Some kinds are best propagated by dividing the roots, as peonies, bleeding-heart, perennial phlox, irises, Japanese anemone, yucca. A few clumps of the strong-growing perennials, taking care of themselves, will insure that something of interest is always transpiring in the garden.

Bulbs.— For early spring bloom nothing is more satisfactory than the class of early-blooming bulbs. Of these, the best are crocuses, tulips, hyacinths, daffodils, jonquils. These species are hardy. Some provision should be made for growing other flowers (as annuals) in the bulb beds in order to make them attractive after the bulbs are done. Once a stock of bulbs is obtained the supply should not decrease much from year to year, if they are given good care.

Roses.— Roses are wanted for bloom, not for the effect of their foliage nor for their beauty as bushes. Therefore they should be grown in a garden by themselves, where they can be tilled and fertilized in order to make them produce a good crop. They need as much care as do corn or potatoes. They should be placed in the flower garden, not on the lawn.

Plants for screens.— Many annual plants make effective screens and covers for unsightly places. Wild cucumber (or echinocystis), cobæa, and sweet peas may be used to decorate the tennis screen or the chicken-yard fence. The alley fence, the smokehouse, the children's playhouse, may be screened with morning-glories, flowering beans, and other twiners and climbers. The windows may be screened and decorated by vines grown either in the ground or in window-boxes.

Efficient screens can be made of many strong-growing and large-leaved plants, of which castor beans, sunflowers, cannas, tobacco and other nicotianas, and striped or Japanese corn are the chief.

Annuals and how to grow them.— The annual flowers of the seedsmen are those that give their best bloom in the very year in which the seeds are sown. The true annuals are those plants that complete their entire life cycle in one season. Some of the so-called annual flowers will continue to bloom the second and third years, but the bloom is so poor and sparse after the first season that it does not pay to keep them.

Most annuals will bloom in central New York if the seeds are sown in the open ground when the weather becomes thoroughly settled. But there are some kinds, as cosmos and moon-flowers, for which our season is commonly too short to give good bloom. These kinds may be started early in the house or in hotbeds; and similar treatment may be given any plants of which it is desired to secure blooms before the normal time.

Prepare the ground thoroughly and deep. Annuals must make a quick growth. See that the soil contains enough humus, or vegetable mold, to make it rich and to enable it to hold moisture. If the ground is not naturally rich, spade in well-rotted manure or mold from the woods. A little commercial fertilizer may help in starting off the plants quickly. Prepare the land as early in spring as it is in fit condition, and prevent evaporation by keeping the surface loose by means of raking.

If the flowers are to be grown about the edges of the lawn, make sure that the grass roots do not run underneath them and rob them of food and moisture. It is well to run a sharp spade deep into the ground about the edges of the bed every two or three weeks for the purpose of cutting off any grass roots that may have run into the bed. If beds are made in the turf, see that they are three feet or more wide, so that the grass roots will not undermine them. Against the shrub borders, this precaution may not be so necessary. It is often desirable that the flowers fill all the space between the overhanging branches and the sod.

Sow the seeds freely. Many will not germinate. Even if all do germinate, the combined strength of the rising plantlets will break the crust on the hard soils; and in the thinning that follows, only strong and promising plants are allowed to remain. Better effects are often obtained when the colors are in masses, especially if the flowers are thrown into the bays of heavy shrub borders.

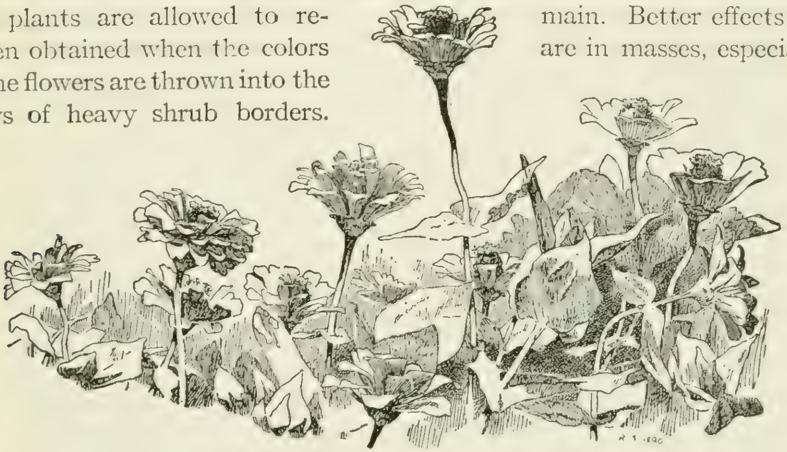

FIG. 42.—*Zinnias. Often known as "youth and old age"*

Plants continue to bloom for a longer period if they are not allowed to produce seeds. The flowers should be picked, if possible, as soon as they begin to fade.

THE FLOWER GARDEN

ALBERT E. WILKINSON

A flower garden is a desirable accompaniment to any farm or home; for flowers give to us something that cannot be supplied by any other object. The variety of color and form in both wild and cultivated blooms satisfies the eye and is of never-failing interest. This interest is now expressing itself in an increased attention to the growing of flowers. Readers desiring a knowledge of the requirements of flowering plants should study carefully the directions given in Lesson 33 of the Cornell Reading-Course for the Farm Home, on Vegetable-Gardening, as the principles there stated apply also to the raising of flowers.

PLANNING

The flower garden needs care in planning just as much as does the vegetable garden or any other piece of constructive work. The planting-table on page 110 shows the height to which various plants normally grow. By arranging the plants according to their height, placing the lowest-growing ones at the front and grading up to the tallest at the back of the bed, a pleasing result may be obtained. If the bed is to be viewed from more than one side, the taller plants can be placed in the center and lower-growing ones toward the outer edges. In this method of planting a mixed border may be used. With such arrangement the plants are not placed in rows or in regular order, yet the results are very satisfactory. If shading of colors also is planned for, the effect will be the more pleasing.

Location of garden

Plan to have the flower garden not over-prominent, and where it will add to rather than detract from the setting of the buildings. Place it at the side or toward the back of the house. A southern or eastern exposure is most desirable.

PREPARATION AND CARE

Preparing the soil

Stake out the garden. Then apply a plentiful coating of well-rotted horse-manure, and turn the manure under with a spading fork or a spade. Just before planting rake the surface of the spaded soil smooth and level. Do not walk on the garden more than is necessary after this work of raking has been done.

Planting

From the planting-table and the directions given below for the various plants, the necessary information may be obtained as to time of planting.

FIG. 43.—*An amateur ideal in chrysanthemums. A mass effect, with many flowers of different ages and sizes*

Of course the dates should be used or varied according to the season, the condition of the soil, and other local considerations.

Nearly all flowering plants may be started in hotbeds or in flats in the house, being transplanted to other flats, hardened in the cold-frames, and later transplanted into the garden, where they are placed in rows at the required distance apart. Shading plants at the time of transplanting aids them to successful growth.

Thinning

If seed is sown directly in the garden, care must be used in thinning the plants properly so that each plant will have ample room in which to develop to the largest size possible.

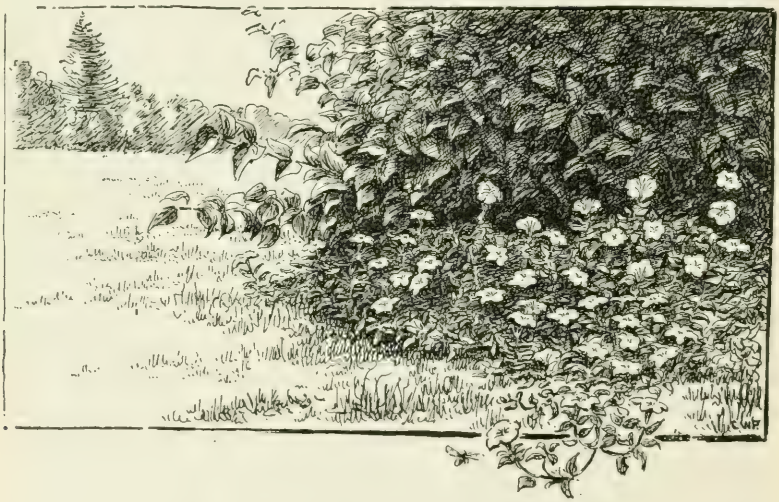

FIG. 44.—*Flowers set against a background*

Watering

At the time of transplanting and in case of drought during the summer, the garden will be greatly benefited by a liberal amount of water, which may be supplied either by hose or with a watering-pot. After the watering is done, ascertain, by means of a stick or with the finger, how deep into the soil the moisture has gone. If there is a dry place in the soil between the topmost layer and the lower moist soil, apply more water.

Cultivating

Nothing helps a garden, both as to final results and as to appearance, more than does good cultivation. A mulch, or fine, light layer of soil,

should be kept on the garden surface. This prevents loss of water from the soil by evaporation; and the treatment necessary in maintaining such a layer should result in the destruction of all weeds. The mulch can be made by hoeing, followed by dragging the rake lightly over the ground.

SOME COMMON FLOWERING PLANTS

Ageratum

Ageratum grows well on a wide range of soils, but sandy loam will give better results than will clay loam. For early bloom the seed should be sown in hotbeds or in boxes in the house in March, and later transplanted to the open ground. For summer or fall bloom the seed may be sown in well-prepared beds outdoors, $\frac{1}{4}$ to $\frac{1}{2}$ inch deep in rows 12 inches apart; later the plants should be thinned to 6 inches apart in the row. The individual plants soon form neat, bushy, erect growths, with a continuous display of pretty blue or white flowers throughout the season.

Ageratum is used frequently in beds and borders, for contrast with other plants.

Dwarf Blue and Dwarf White are desirable varieties.

Alyssum

A well-prepared, rich soil is best suited to alyssum. The seed may be planted $\frac{1}{4}$ to $\frac{1}{2}$ inch deep in rows 12 inches apart; later the plants should be thinned to 6 inches apart in the row. Alyssum is a hardy annual, which grows $\frac{1}{4}$ to $\frac{1}{2}$ foot high and blossoms from June to frost. If the dying flower-stalks are cut back after the first bloom, others will be produced, and a profusion of bloom may thus be obtained throughout the season.

Alyssum is of the easiest culture, both indoors and out. It is well suited for beds and borders in summer and for boxes indoors in fall or winter.

Some good varieties of alyssum are Saxatile Compactum (yellow), a perennial, and Maritimum, an annual. Little Gem is the best of the white annual varieties.

Antirrhinum (*Snapdragon*)

The seed should be sown in the hotbed in March, the plants being later transplanted to the garden in rows 12 inches apart, with 12 inches between the plants in the row. This hardy perennial, which grows to a height of 12 to 36 inches, will give satisfactory blossoms the first year. The blooming season lasts from July until frost. Snapdragon thrives best in a light, warm, well-enriched soil. Most of the varieties

PLANTING-TABLE

Name of flower	Amount of seed for 10 ft. of row	Time to plant		Distance apart (inches)		Depth to plant seed (inches)	Hardy, half-hardy, or tender	Height to which plants grow (feet)	Annual—A Biennial—B Perennial—P	Season of blooming
		Hotbed	Open ground	Between rows	Between plants in row					
Ageratum	1 pkg.	March	May	12	6	¼ to ⅓	Hardy	½ to ¾	A	June to frost
Alyssum	1 pkg.		May	12	6	¼ to ½	Hardy	¼ to ½	A	June to frost
Antirrhinum	1 pkg.	March	May	12	12	¼ to ½	Hardy	1 to 3	P	July to frost
Aster	1 pkg.	March	May	12	9 to 12	½ to ¾	Hardy	1 to 3	A, P	July to Oct.
Balsam	1 pkg.	April	May	24	24	½ to ¾	Tender	2 to 2½	A	July to frost
Calendula	1 pkg.	April	May	12	6	¼ to ½	Hardy	⅔ to 1	A	June to Oct.
Campanula	1 pkg.	March	April or May	12 to 18	12	¼ to ½	Hardy	2 to 3	A, P	June to Aug.
Candytuft	1 pkg.	April	May	12	4 to 6	¼ to ½	Half-hardy	½ to ⅚	A	June to Oct.
Centaurea	1 pkg.	April	May	18	6	¼ to ½	Hardy	2 to 3	A	June to frost
Chrysanthemum	1 pkg.	March	May	12 to 18	8	½	Hardy	1 to 4	A	June to Oct.
Cockscomb, low	1 pkg.	April	May	18	12	¼ to ½	Hardy	1 to 1½	A	June to frost
Cockscomb, tall	1 pkg.	April	May	24	24	¼ to ½	Hardy	3	A	June to frost
Convolvulus (morning-glory)	1 pkg.		April	To climb on some support	6	½ to ¾	Hardy	10 to 15	A	June to frost
Coreopsis	1 pkg.	March	April	18	10	½	Hardy	1½ to 2	A, P	June to frost
Cosmos	1 pkg.	April	May	24 to 30	24	½	Hardy	4 to 8	A	July on*
Dahlia	1 pkg.	March	May	12 to 18	6	½	Half-hardy	4	P	Aug. to frost
Dianthus	1 pkg.	March	May 1–10	12 to 18	6	¼ to ½	H, lf-hardy to hardy	1 to 1¼	A, P	July to frost
Hollyhock	1 pkg.	March	July to September	24 to 36	15	½	Hardy	5 to 7	P	Aug. on
Larkspur	1 pkg.	March	May	12	12	¼ to ½	Hardy	1 to 5	A, P	June to Sept.
Marigold	1 pkg.	April	May	12	6	¼ to ½	Tender to half-hardy	½ to 2	A	July to frost
Mignonette	1 pkg.	March	May	12	12	¼ to ½	Tender to half-hardy	1 to 1½	A	July to frost
Nasturtium	1 pkg.	April	May	12	12	½ to ¾	Half-hardy	¾ to 1	A	June to frost
Pansy	1 pkg.	March	April	12	6	¼ to ½	Hardy	⅓	A	April to frost
Petunia	1 pkg.	Feb. or Mar.	May	12	12	¼	Hardy	1	A	June to frost
Phlox (annual)	1 pkg.	March	May	18	12	¼ to ½	Hardy	1	A	June to frost
Poppy	1 pkg.		Apr., Sept., Oct.	12	12	¼	Hardy	1 to 2	A, P	June to Aug.
Salvia	1 pkg.	March	May	24	18	¼ to ½	Half-hardy—P to hardy—A	2 to 3	A, P	Aug. to frost
Stock	1 pkg.	March	May	18	12	¼ to ½	Hardy	1 to 1½	A, B	July to Sept.
Sunflower	1 pkg.	April	May	36 to 60	24 or more	1	Hardy	6 to 10	A	Aug. to frost
Sweet peas	2 pkgs.		April	36 to 48	Thick	1 to 1½	Very hardy	2 to 6	A	July to Sept.
Sweet william	1 pkg.	March	June	12	6	¼ to ½	Hardy	1½ to 2	A, P	June, July

* Early, July to August. Late, September to October.

are fairly hardy and with proper covering will withstand winter in most sections of New York State.

The varieties are divided into two classes, the tall and the dwarf Grandiflora. Varieties of the first are Queen Victoria, Crimson, Pink, Scarlet, Yellow, and Striped; of the second, Golden Queen, Black Prince, Empress, Crimson, Scarlet, and others.

Aster

The aster, a popular flower, requires for its best development well-rotted manure thoroughly worked into soil. The seed may be sown

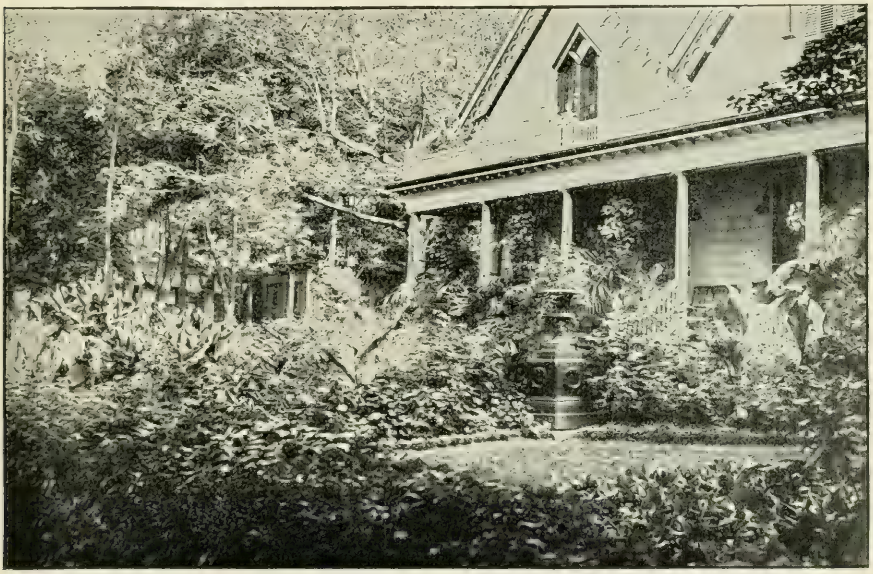

FIG 45.— *One method of planting*

outdoors in May, $\frac{1}{2}$ to $\frac{3}{4}$ inch deep in rows 12 inches apart; later the plants should be thinned to 9 to 12 inches apart in the row, as such thinning results in fine bloom during September and October. For early bloom plants should be started in the hotbeds in March and transplanted to the open ground after all danger from frost is past. Small quantities of air-slaked lime or wood ashes stirred into the surface of the soil will greatly benefit the plants.

The average height of asters is 1 to 3 feet. By systematic planting it is possible to have the plants in bloom from July to October.

There are both annual and perennial varieties. Some of the best strains are Giant Japanese, Comet, Chrysanthemum, Ostrich Feather, Victoria, Concord, Vicks Branching, and Washington.

Balsam

Balsam flourishes in a rich soil with plenty of moisture, and in hot, sunny weather. For early bloom the seed may be sown in April, in hotbeds or in flats kept in the house. Transplanting two or three times has a tendency to dwarf the plants, giving them a better shape and making them more productive of flowers. For outside planting the seed may be sown in May, $\frac{1}{2}$ to $\frac{3}{4}$ inch deep in rows 24 inches apart, and the plants thinned when 4 or 5 inches tall to 24 inches apart in the row. The plants are tender. Balsam grows to a height of 2 to $2\frac{1}{2}$ feet.

There are double white, double red, camellia-flowered, carnation-striped, rose-flowered, and dwarf-aster-flowered varieties.

Calendula (Pot marigold)

Calendula thrives best in a warm, loose garden soil. The plants may be raised in the hotbed and later transplanted; or the seed may be sown in the garden in drills $\frac{1}{4}$ to $\frac{1}{2}$ inch deep, with rows 12 inches apart and plants 6 inches apart in the row. Calendula is a hardy annual and its average height is about 8 to 12 inches. Blooms appear from early June until late October.

Some of the best varieties of calendula are La Proust, Nankeen, Cape Marigold, and the pale yellow Sulphurea.

Campanula (Canterbury bells)

The hardy annual or perennial campanula requires a rich garden soil for its best development. The seed may be sown in the open ground $\frac{1}{4}$ to $\frac{1}{2}$ inch deep, in rows 12 to 18 inches apart, the plants being thinned later to 12 inches apart in the row. The average height of the plant is 2 to 3 feet. Blooms may be obtained from June to August; they are very beautiful, especially when a good mixture of varieties is used. If blooming is desired the first year, the plants should be started in the hotbed in March.

Among other varieties there are rose and white, both single and double.

Candytuft

A rich garden soil is best suited to candytuft. This plant is called a half-hardy annual. The seed may be sown in the garden about the last of April or the first of May, $\frac{1}{4}$ to $\frac{1}{2}$ inch deep in rows 12 inches apart; when about an inch high the plants should be thinned to 4 to 6 inches apart in the row, thus allowing them to branch freely and produce larger flowers than they would otherwise. Another planting may be made about the last of June for fall flowers.

Candytuft is used for beds, for belt or mass planting, and somewhat for rock work. The plants are free bloomers and some of them have very fragrant flowers. The average height of the plant is 6 to 10 inches. For edging beds the white flowers of the candytuft are desirable. There are also carmine, crimson, rose pink, and purple varieties.

FIG. 46.—*A plant such as any one may raise in the home window*

Centaurea (Cornflower)

A good garden soil is desirable for the hardy annual centaurea. The plants may be grown in the hotbed in April and transplanted later to the open ground; or the seed may be sown in the garden in May, $\frac{1}{4}$ to $\frac{1}{2}$ inch deep in rows 18 inches apart, the plants being thinned later to 6 inches apart in the row. The average height of the plant is 2 to 3 feet. Blooms are produced from June until the plants are killed by frost.

The cornflower has a great variety of colors — blue, green, red, pink, lilac, purple, and white; there are sweet-scented varieties, also both single- and double-flowering varieties. The bachelor's-button belongs to this group and is the best-known representative.

Chrysanthemum (annual, or summer-flowering)

The hardy annual chrysanthemum is of easy culture. The plants may be grown in the hotbed and later transplanted; or the seeds may be sown in good garden soil in May, $\frac{1}{2}$ inch deep in rows 12 to 18 inches apart, the plants being thinned later to 8 inches apart in the row. The effect of transplanting is noticeable on these plants; they become more dwarfed and branching, and give better blooms. The average height of

the plants is 12 to 48 inches. The blooms are produced from June until October.

This plant is used to a great extent in beds and borders, especially where a showy plant is needed. This is not the popular fall-flowering type of chrysanthemum. In Figs. 43 and 46 the popular greenhouse, or fall-flowering, types are shown.

Good varieties are Coronarium — which may be white or yellow, double or single — and Tricolor.

Cockscomb

Cockscomb plants may be grown from seeds sown in the hotbed the first of April or in the cold-frame in May, and transplanted to the open ground about the middle or last of May. If rich soil is supplied for the transplanted seedlings, the result will be larger flower masses than would otherwise be obtained. The rows should be 18 inches apart for the low varieties and 24 inches for the tall, and the plants 12 and 24 inches, respectively, apart in the row. The average height of the low varieties is 12 to 18 inches, and of the tall varieties 36 inches.

There are two distinct types of cockscomb, the Cristata and the Plumosa. The latter is by far the more decorative of the two. There are copper-colored, dark crimson, purple, golden-yellow, rose, scarlet, and violet varieties of cockscomb.

Convolvulus (*Morning-glory*)

Convolvulus is an old garden favorite. It is a climbing or running plant, often growing to a height of 10 to 15 feet when trained over a lattice or a trellis or the side of a house. The seed may be planted in the open ground in April, about ½ to ¾ inch deep, generally in a single row. The plants should be thinned to 6 inches apart.

The Japanese varieties of morning-glory are desirable, as they have fine, large flowers. There is a morning-glory of dwarf habit, called Convolvulus Minor, which has flowers of many colors; the plant grows to the height of but 1 foot. Convolvulus Major, which includes the Japanese and the Double Morning-glory, of mixed colors, is the common climbing or running variety.

Coreopsis (*Calliopsis*)

Coreopsis is a hardy annual or perennial plant that grows to a height of 18 to 24 inches. It may be started in the hotbed in March and later transplanted to the garden, or the seed may be sown in the open ground in April about ½ inch deep in rows 18 inches apart; when the seedlings

are 4 or 5 inches tall they should be thinned to 10 inches apart in the row. The annual flowers bloom from June until they are killed by frost. The flowers of both the perennial and annual varieties last for a long time after being cut.

This is a showy plant, much desired for garden decoration and for cut flowers. The perennials are hardy border plants.

Some of the best varieties are Radiata — either yellow or dark brown — Bicolor Marmorata, Tom Thumb Crimson King, and Grandiflora.

Cosmos

Cosmos is a hardy annual. It may be grown in April in the hotbed and transplanted to the garden; or the seed may be sown in the garden in May, $\frac{1}{2}$ inch deep in rows 24 to 30 inches apart, the plants being thinned later to 24 inches apart in the row. This plant is greatly benefited by applications of potash. Also, good results are obtained by transplanting once or twice; such transplanting makes the bush more compact and the flowers larger. Cosmos must have full sunshine for successful growing. The average height of the plant is 4 to 8 feet.

Good varieties of cosmos are Mammoth for late, and Lady Lennox for early, blooming.

Dahlia

The dahlia may be grown from seed. The seed may be sown rather early in the hotbed or the cold-frame; or it may be sown in well-prepared garden soil in May, in drills $\frac{1}{2}$ inch deep and 12 to 18 inches apart, the plants being thinned later to 6 inches apart in the row. The plants grow to a height of about 4 feet. Clean culture should be given throughout the season.

The roots are taken up in the fall and stored over winter. In spring they may be divided before replanting, thus producing a larger number of plants. The roots should be planted in deep, rich soil.

Some of the best types of dahlia are Cactus, Double Grandiflora, Pompon, Tom Thumb, and Peony Flowered.

Dianthus (Pink) and Annual Carnation

Dianthus is an annual or perennial, of both hardy and half-hardy character. It may be started in the hotbed in March, being later transplanted to well-prepared garden soil; or the seed may be sown in the garden from the 1st to the 10th of May, in drills $\frac{1}{4}$ to $\frac{1}{2}$ inch deep and 12 to 18 inches apart, the plants being 6 inches apart in the row.

The annuals will give a profusion of bloom from July until they are killed by frost. They are exceedingly ornamental and are equally suitable for beds, borders, house decoration, and cuttings.

The Heddewegii, Diadematus, and Caryophyllus are perhaps the most notable types of dianthus. They are of various colors.

Hollyhock

The hollyhock is a hardy perennial that grows to a height of 5 to 7 feet and produces a fine mass of bloom in August. The seed should be sown from July to September in garden soil, ½ inch deep in rows 24 to 36 inches apart; later the plants should be thinned to 15 inches apart in the row or transplanted to a permanent location. The hollyhock should be protected through the winter with straw or similar material. The next spring the plants will start growth and will later produce flowers. Abundance of water and a liberal supply of manure are necessary for the best growth of this fine perennial.

Chater's Double is one of the best strains and produces flowers of various colors — apple-blossom pink, bluish white, canary-yellow, carmine, lemon-yellow, dark maroon, pink, salmon-pink, and variegated.

Larkspur

The larkspur is a hardy annual or perennial that thrives in any good garden soil; the flowers are of much better color and size, however, when the plants are grown in a deep, rich sandy loam, one that has been spaded deeply and well enriched with old rotten manure being the best. The seed of the dwarf varieties may be sown in the open ground in May, at a depth of ¼ to ½ inch in rows 12 inches apart; a little later the plants should be thinned so as to stand 12 inches apart in the row. The average height of the larkspur is 1 to 5 feet.

The tall varieties, all of which are perennial, are suitable for setting among shrubbery and in borders. The dwarf varieties are effective for beds.

Some of the best varieties of larkspur are: annuals, Bismarck, Giant Hyacinth Flowered; perennials, Elatum, Formosum, Grandiflorum Album.

Marigold

The marigold is easily cultivated. It requires a good garden soil — a good sandy loam being the best — but not necessarily a rich soil. Marigolds are tender to half-hardy annuals that grow to a height of 6 inches to 2 feet. The plants may be grown in hotbeds and later transplanted, or the seed may be sown in the open ground. In the latter case, seed should be sown in May, ¼ to ½ inch deep in rows 12 inches apart, the plants being thinned later to 6 inches apart in the row. Blooms are produced from July until the plants are killed by frost. Frequent trans-

planting results in short, stocky plants that produce many good-sized flowers throughout the season.

Some of the best strains are Scotch Prize, French Tall Double, and Signata Pumila.

Mignonette

Mignonette is a tender to half-hardy annual that attains a height of 12 to 18 inches and is easily and successfully grown in any good garden soil. It is very sensitive to transplanting and the seed should be sown in the ground in May, $\frac{1}{4}$ to $\frac{1}{2}$ inch deep in rows 12 inches apart, the plants being thinned later to 12 inches apart in the row. The fragrant, modestly colored flowers make this plant a favorite among garden lovers.

Some of the best varieties are Grandiflora, Machet, Golden Queen, and Victoria.

Nasturtium

The nasturtium is a half-hardy annual that produces a profusion of bloom from June until frost. Too rich soil leads to increased leaf development and often to the rotting of the plants in wet weather. A thin, poor soil is much more likely to result in a large amount of bloom. The plants may be grown in the hotbed during April and later transplanted; or the seed may be sown in May, in drills $\frac{1}{2}$ to $\frac{3}{4}$ inch deep and 12 inches apart, the seedlings being thinned when about 2 inches tall to 12 inches between plants. Blossoms on dwarf varieties appear in two months after the seed is sown, and blooming continues throughout the season if the blossoms are picked. The plants have a neat, compact habit of growth, with very attractive foliage.

There are dwarf varieties of nasturtium, such as Aurora, Empress of India, Golden King, King of Tom Thumbs, Ruby King; there are tall, or climbing, varieties, such as Edward Otto, King Theodore, Moonlight, Sunlight, Vesuvius; there are the Tropæolum varieties, such as Brilliant, Crown Prince, Giant of Battles, Lucifer, Roi des Noirs; and there are other varieties.

Pansy

The pansy thrives best in a cool, rather moist, well-prepared garden soil. The seed may be sown early in April, in drills about $\frac{1}{4}$ to $\frac{1}{2}$ inch deep and 12 inches apart; when about 2 inches tall the plants should be thinned to 6 inches apart. For the best results the plants and flowers require some shade during the heat of summer. Systematic picking of the blooms, allowing no seeds to form, will lengthen the flowering period. For early spring bloom the seed should be sown early in the preceding fall in a cold-frame, in rich, moist, well-prepared soil. The plants develop during the fall and early winter. Some covering for protection during

winter is necessary. In spring the plants should be transplanted to beds or borders, where they will bloom early. The pansy may also be produced for somewhat early blooming by growing the plants in hotbeds from seed sown early in the spring, and transplanting later to the open ground. The average height of the pansy is about 4 inches. It is hardy.

There are many strains of pansies, some of the best being English Fancy, Scotch Prize, Parisian, Trimardeau (or Giant), and Large-Flowered. In these strains are blooms of many different colors, either solid or variegated.

Petunia

The petunia should be started in February or March in the hotbed and later transplanted to the garden. The seeds of petunia are very small

FIG. 47.—*A plain farm home, but a pleasant place in which to live. The broad, open lawn adds greatly to the appearance and comfort of the place*

and it is almost impossible to sow them shallow enough to insure their germinating. This is the chief reason why they should be started in the hotbed. Also, the plants are very tender, and it is therefore not advisable to sow the seed in the garden until all danger of frost is past, generally in May or June. The seed may be sown $\frac{1}{4}$ inch deep or less, in rows 12 inches apart; the plants should be thinned later so as to stand 12 inches apart in the row. The average height of the plant is 12 inches. The blooms are continuous from June until the plants are killed by frost.

Petunias are effective in borders and beds and for cut flowers.

The hybrida large-flowered are desirable kinds of petunias, such as the Alba, Purple King, Fimbriata, Prize, and others.

Phlox (annual)

Few annual plants are more easily grown from seed, give a quicker return of bloom, or offer a greater number of colors, than the varieties of phlox. A good garden soil, well prepared, with the seed planted to a depth of $\frac{1}{4}$ to $\frac{1}{2}$ inch in rows 18 inches apart and the plants later thinned to stand 12 inches apart, will undoubtedly give the best results. Seeds may be planted in the hotbed, also, or in a box in the house, and the seedlings later transplanted to the garden. The average height of phlox is 12 inches. In order to make the plants bushy and to lengthen their blooming period, all flowers should be removed as soon as they begin to fade.

The annual phlox is designated *Phlox drummondii grandiflora.* Under that one head are many varieties, among which are Alba, Coccinea, and Rosea.

Poppy

The poppy is a hardy annual or perennial that grows to a height of 1 to 2 feet. It does not well bear transplanting and therefore it is not recommended for hotbeds. It may be started in the garden in April, or in September and October. The seed should be sown $\frac{1}{4}$ inch deep in rows 12 inches apart; the plants should be thinned later to 12 inches apart in the row. A sandy-loam soil will give the best results. Flowers can be produced by extremely early sowing in such soil, so that from June until August there will be many blooms. Later plantings will continue the blooming period throughout the season.

Alpinum, Iceland, Shirley, the Orientale Hybrids, and other mixed collections are highly recommended.

Salvia

Sandy loam, fairly rich, promotes good growth and bloom of the bright-colored, late autumn, annual or perennial salvia. The seed may be sown outdoors in May, $\frac{1}{4}$ to $\frac{1}{2}$ inch deep in rows 2 feet apart. As salvia is a large-growing plant it must be thinned to 18 inches apart in the row. It is best to start the plants in the hotbed and transplant them into the garden, giving them the amount of space already designated. The average height of the plant is 2 to 3 feet.

The best use for salvia is as a hedge or border plant, especially where intense color is desired. It is also effective in beds.

Two of the most important varieties of salvia are Bonfire and Splendens.

Stock (Ten Weeks)

The plants have a compact habit of growth, are very vigorous, and have fragrant flowers in many colors. They have a long blooming season.

They are grown successfully on a wide range of soil. Good garden soil, well prepared, will result in fine blooms. The seed should be planted outdoors in May, $\frac{1}{4}$ to $\frac{1}{2}$ inch deep, in rows 18 inches apart; the plants should be thinned later so as to stand 12 inches apart in the row. For early bloom the seed should be sown in hotbeds. If transplanted once or twice the plants will be in the best condition for the development of a large number of fine blooms. The average height of the plant is 12 to 18 inches.

Stocks are useful for beds, borders, pot culture, and cuttings, and in conservatories.

Sunflowers

Sunflowers may be grown in hotbeds and transplanted; or the seed may be sown in the garden 1 inch deep in rows 36 to 60 inches apart, the plants being thinned later to 24 inches or more apart in the row. The average height of the plant is 6 to 10 feet. The blooms are produced from August until the plants are killed by frost.

Sunflowers are much used for backgrounds in flower planting or for concealing fences.

Some of the best varieties are Texas Silver Queen, Giant Russian, Orion, and Double Flowered.

Sweet peas

The sweet pea is a very hardy annual and is of easy culture. It produces a large amount of bloom from July until September, especially if the flowers are picked and no seed is allowed to form. Sweet peas should be planted in April, 4 to 5 inches deep in double rows 8 inches apart, and should be covered with but 1 to $1\frac{1}{2}$ inch of soil; as the plants grow, soil should be filled in around them until the level of the surrounding ground is reached. The seed should be planted thick. If more than one double row is needed, the double rows should be 3 to 4 feet apart. Good garden soil, not too rich in nitrogen, will give the best results. A sunny situation is best. The plant grows to a height of 2 to 6 feet.

Many varieties of the old formal type of sweet peas are still favorites; but since the introduction of the loose, wavy Spencer type, this type has practically superseded the former.

Sweet william

A pleasing perennial in every old-fashioned garden is sweet william, which is a member of the dianthus family. It requires a good garden soil in the best condition, in which the seed may be sown in June or later, $\frac{1}{4}$ to $\frac{1}{2}$ inch deep in rows 12 inches apart, allowing at least 6 inches between the plants when they are 2 or 3 inches tall. For early bloom, plantings may be made in the hotbed in March.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 35 | ITHACA, N. Y. MARCH 1, 1913 | GARDEN SERIES No. 2

THE FLOWER GARDEN

DISCUSSION PAPER

Discussion paper to be returned to Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

While the season now is teeming with work and hurry, there is just as much need as ever for recreation. Many will find this in the flower garden. Something is imparted from the soil and from the flowers which nothing else will supply to the æsthetic nature. The flowering plant in the window is as inspiring in the busy housewife's world as are the orchids in a greenhouse. What may we have in this discussion paper as the result of your experience?

1. What is the size of your lawn or front yard?

2. What do you think of Lowell's point of view in his poem "To a Dandelion"?

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

3. If you could command the labor, how would you like to treat your garden and front yard?

4. What is your experience in providing flowers for your family and your friends? Does any other intention give better results?

5. Name the annual flowers that have given the most satisfaction.

6. What has been your experience with roses?

7. What perennials yield the best returns for labor?

8. What insect pests or plant diseases have most disturbed your plans for a garden?

Name. . . . .

Address. . . . .

Date. . . . .

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. Bailey, *Director*

Course for the Farm Home, Martha Van Rensselaer, *Supervisor*

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HOME ECONOMICS AT THE NEW YORK STATE COLLEGE OF AGRICULTURE

Martha Van Rensselaer

A large amount of money is spent yearly in order to place farming on a scientific basis. No one questions the wisdom of such expenditure. Thoughtful persons are realizing also the necessity of spending money in teaching women the science of home-making, in order to increase human efficiency. They are realizing the importance of woman's work and the desirability of standardizing it so that her time and effort may be used economically.

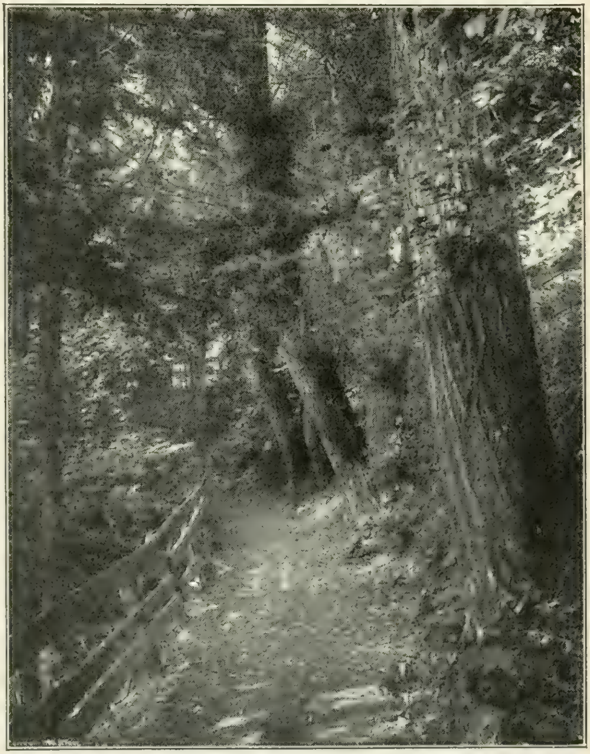

Fig. 48.—*Forest Home walk in the rear of the Home Economics Building*

Agriculture is the science, or the meeting-point of many sciences, treating directly and indirectly of animal welfare. Home economics is also the meeting-point of many sciences, often identical with those of agriculture, but it applies their principles to the more important phases of human

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welfare. It includes a study of foods, their selection, and their preparation; the relation that right diet bears to the health of the body and to the development and efficiency of the individual; conditions of living necessary to insure health and efficiency; intelligent use of income in procuring food, shelter, and clothing; principles of art as applied to decoration of house and of person; social and industrial forces that govern the home and its activities; the child, and conditions that control its inheritance and environment.

Men are interested in the production of raw material; women, in the use of that material. Farmers strive to produce good wheat, corn, and other farm products; women must endeavor to use these products aright. A balance in progress is not being maintained if men are educated so as to obtain the best products while women remain in ignorance of the principles underlying their use.

There are excellent cooks, it is true, who have never studied chemistry and who know nothing of the physiological needs of the body; but, important as is good cooking to the welfare and happiness of the family, it is only one phase of woman's important work. Women should know the use and the place of foods in the dietary; the comparative value of a food element as it occurs in one food or another; the relation of cooking to digestion; the dietary needs of man, woman, and child; the principles of bread-making, meat and vegetable cookery, canning and preserving. In other words, women should know not only how to cook and what to cook, but also what to omit from the dietary.

A woman needs to know the relation of germ life to disease, of cleanliness to health and well-being; the physiological needs of the body for fresh air, clean water, wholesome food, sunshine, exercise, and rest; the management of the income in the buying of food, shelter, and clothing; the principles of art as they apply to the artistic arrangement of furnishings and wearing apparel; the characteristics and values of fabrics, and how to distinguish those goods that are genuine from those that are not; the relation of consumer to producer and of employer to employee; the needs of the house as a workshop wherein the time and energy of the worker have a market value; the maintenance of proper standards of living as indicated by wise expenditures.

With the prospect of obtaining scientific training in agriculture the boy may attend an agricultural college; and in like manner opportunity for special training in home-making should be the privilege of every girl. If boys in the family were trained for the work of life and girls continued without educational stimulus, a new social problem would soon be presented. In the resulting civilization the majority of men would understand the handling of machines, business management, and the culture and

breeding of plants and animals; while the women would not understand the scientific management of the home or the principles of human nurture and breeding. A study of social and biological sciences with emphasis on the needs of the human being will undoubtedly help to make a better and more efficient race, and will serve to complement the endeavors of those who are perfecting the raw materials.

It is often asked, "Why should home economics (domestic science) be taught in the schools? Why should not the daughter learn from her mother what she needs to know about housekeeping?" The answer to such a question is the same as the answer to a similar question: "Why cannot the farmer give his son all the instruction that he needs in order to make him a good farmer?" Agriculture and home economics embrace subjects founded on science. The mother can teach her daughter to cook, but she may not be able to teach her how she can plan a balanced meal; why the fruit spoils, or the bread does not rise; why the baby of five months should not eat bananas; why last winter's green dress has turned yellow; why she dislikes the new wall paper; how she can design an artistic, inexpensive dress, or rightly furnish and decorate a room. As the young person studies grammar, arithmetic, and history at school, so should she study also the subjects of home economics, because they are founded on a scientific basis and demand definite and systematic study.

Many mothers have a thorough knowledge of grammar and arithmetic and still prefer for their daughters the organized instruction of the schoolroom. Mothers may likewise have a thorough knowledge of home economics and, if possible, should teach their daughters to cook and to sew; yet they may appreciate the advantages of obtaining such education in a well-organized institution.

Home economics should find its way into the curriculum of every school, because the scientific study of a problem pertaining to food, shelter, or clothing — whether the baking of a loaf of bread, the washing of dishes, the planning of a more convenient kitchen, or the making of a well-fitting kitchen apron — raises manual labor that might be drudgery to the plane of intelligent effort that is always self-respecting.

Young persons often dislike a task exceedingly because they see no reason for it and have not learned the rhythm of the homely duty. It represents distressing monotony to them. When they are given a reason for its performance and are shown its rhythm, they find pleasure in the task once so distasteful. By right training, therefore, the tasks of the household may be lifted to a place of dignified effort.

Not long ago a woman was seated at a luncheon prepared by a class in home economics. She had been graduated from a normal school, had received a college degree, had taught for several years, and finally had

given up her professional work in order to be married. As she sat at the table and saw the ease and simplicity of the service and the interest of the young women assisting, she said very wistfully, "Oh! I wish I knew how to keep house; but you see I have never had time to learn, for I have been in school all my life." That young woman is one of many who make the same complaint. It is a travesty on our system of education for women to stand thus helpless before the task of home-making, which sooner or later the majority of them will assume.

The wealth of a nation is said to be its life, and life begins in the home. Women are the mothers of the race and the entire subject of home eco-

FIG. 49.—*Institute workers of 1913 entertained in the cafeteria of the Home Economics Building*

nomics centers around the child. Life means not merely thought for the material comforts of to-day, not transient happiness for the individual, but intelligent consideration of posterity, of the happiness and welfare of children.

How will the human race be affected if the mothers are left untrained?

WOMAN'S PLACE IN THE SCHEME OF AGRICULTURAL EDUCATION

(Abstract of remarks by Dean Bailey before the Girls' Club of the College of Agriculture, November 11, 1910)

You may ask me why I need to raise the question of woman's place in any scheme of education. The reason is purely historical. Woman has not had her recognized place in schemes of education.

We know that education has come up out of class and of privilege. Not all men, let alone women, have had equal opportunities in the plans of education. In the evolution of educational institutions, all persons are now finding their places and are contributing their several parts to the various schemes.

The ultimate object of education by means of agriculture is to redirect country life. The redirection of country life rests on two corner stones, which are, improved farming and improved home-making. If it is essential that the man be trained in better farming methods, it is equally essential that the woman be trained in better householding methods.

The farm and the home are the two underlying factors in the country-life development. As the strength of a chain is determined by its weakest link, so will the development of rural civilization be determined by the weakness of the farm as an economic unit or by the weakness of the home as a social unit. It follows, therefore, that the woman has equal and coordinate part with the man in the redirection of rural society. Not only will she be able to create a sentiment for better farming itself, but it is to be expected that her best contribution will be to create a quickened sentiment in respect to the home-making and householding end of country life. I do not mean to restrict woman's activities, but we must recognize the law of nature that certain activities are primary and others are secondary.

The farm woman's outlook

The farmer has lived on his farm; he is now acquiring a world outlook.

The woman has lived in her house; she also is acquiring a world outlook.

As the house has been smaller and more confining than the farm, it has followed that woman's outlook has been smaller than man's.

As the effectiveness of the farmer's outlook is conditioned on his ability as a farmer, so the effectiveness of a woman's outlook is conditioned on her ability as a home-maker. This is why this College of Agriculture aims first to make a man a good farmer; it is equally the reason why it aims first to make a woman a good housekeeper. To put the matter in another phrase, as it is the first necessity that the countryman be a good business man, so it is of the first importance that the country woman should be domestic. I should not restrict this remark to country men or country women. It is equally applicable to all other men and women.

Whatever a woman may gain, she must never lose her domesticity. Her effectiveness as a social agent depends directly on her retaining the natural womanly qualities.

Things and affairs that formerly have been in the foreground may now need to be relegated to the background. We are placing new values on all activities. I will mention a few of these in order that you may

know exactly what I mean. I am saying them not because they may be peculiar to women, but because I am speaking to women.

1. Women must escape the customary small range of conversation. The smaller the range of conversation, the more narrow is the horizon of life. Very small conversation is gossip. The gossiper is always a self-centered person. The measure of one's contact with life is necessarily reflected in the subjects of conference and conversation. You have only to take note of the conversation of groups of men and women anywhere to satisfy yourselves of this fact. We ordinarily condemn gossiping as wrong

FIG. 50.— *Sitting-room in the Home Economics Lodge*

from the moral point of view; I prefer at present to say that it indicates a small range of interests and does not develop such contact with life as is worth while.

2. It is bound to be necessary, if woman is to take her larger part in the world's activities, that she develop a different attitude toward personal apparel. I do not have it in mind to criticize any garment that a woman wears. I do not know of any garment that is more inartistic and more ludicrous than a man's dress coat; but the point is not here. Men's clothing is standardized. Women's clothing is to a large extent not standardized. Men's styles change from year to year, but the range is

very narrow. The result of it is that a man expends much less energy in providing apparel than a woman does. I presume that we should never standardize women's clothing so narrowly as men's clothing is standardized, but there is certainly need of much effort in that direction. I think it is the place of college women to spread the idea that first-rate artists in clothing should be employed in women's work and to overcome the notion that radical styles may be set arbitrarily. Very much human energy is wasted in trying merely to readapt oneself to changing fashions, which are largely set by commercial firms that they may obtain financial advantage therefrom. This handicap is well recognized by educated women. The difficulty is that the trades in women's apparel have not yet caught up with our best judgment, and the women of the present day are living, therefore, in a trying position.

3. I think that educated women who are to carry much responsibility of the world's work must overcome some of the common notion that they are of right to be "entertained." A person who is resourceful entertains himself or herself. Of course I do not mean by this that one is to withdraw from associations with one's fellows, or in any way to isolate oneself; it is possible to be resourceful without being separate.

4. The means whereby woman is to broaden her influence is, first to broaden her own and undisputed sphere and not merely to adopt man's sphere. In the nature of things, there is division of labor between men and women. If there are certain duties that inhere in man's estate, there are certain other duties that inhere in woman's estate. I have no desire to say what a woman's work shall be; but it is very apparent that she must be master of her own problem before she can solve another's problem.

The Department of Home Economics

If the customary subjects in the College of Agriculture are organized and designed to train a man for efficiency in country life and to develop his outlook, so also is the Department of Home Economics in this College to train a woman for efficiency and to develop her outlook to life. A department of home economics, therefore, is not a concession to public opinion, or even alone to the special needs of woman's education. It is a necessity as a means of developing society.

Home economics is not one department, in the sense in which dairying or entomology or soils is a department. It is not a single specialty. It stands for the whole development of woman's work and place. Many technical or educational departments will grow out of it as time goes on.

Of course, I would not limit the entrance of women into any courses in the College of Agriculture; on the contrary, I want all courses open to them freely and on equal terms with men: but the subjects that are arranged

under the general head of home economics are their special field and sphere. On the other hand, I do not want to limit the attendance of men in courses of home economics; in fact, I think it will be found that an increasing number of men desire to take these subjects as the work develops, and this will be best for society in general.

Furthermore, I do not conceive it to be essential that all the teachers in home economics subjects shall be women; nor, on the other hand, do I think it is essential that all teachers in the other series of departments shall be men. The person who is best qualified to teach the subject should be the one who teaches it.

My attitude, therefore, is that home-making subjects are just as essential a part of a college of agriculture as any other subject whatever, and that we cannot expect to make much progress in the redirecting of country life until these subjects are as well developed as the technical agricultural subjects. There is no longer any necessity of explaining why home-making subjects are necessary in this institution. The number of young women is increasing. The work is recognized as of equal value and standing with other work. It will grow and will take care of itself. I hope for the time when there will be as many women in the College of Agriculture as there are men.

HISTORY OF THE DEPARTMENT OF HOME ECONOMICS IN THE COLLEGE OF AGRICULTURE

Home economics at Cornell University began in a modest way. In 1900, L. H. Bailey, then a professor in the College of Agriculture, recommended that a series of pamphlets be sent to farmers' wives comparable with the reading-course that for several years had been in circulation among farmers. Subjects of interest in the daily round of the household duties of the farmer's wife were considered worthy of special study. At that time 6,000 farmers of the State of New York were enrolled in a reading-course for the farm. A circular letter to farm women was sent out with each of the 6,000 farm bulletins, as it was assumed that the farmers all had wives and that their wives would be interested in the letter. Two thousand replies were returned, with a request to be enrolled in the new course for farm women. The text of the letter was as follows:

ITHACA, NEW YORK, January, 1900.

To the Farmer's Wife:

Ever since the inauguration of our Farmers' Reading-Course, it has been our plan to make it a partnership course between you and your husband. In all the vocations of life, there are none in which success depends so much upon the wife as in farming, and we never think of an unmarried farmer. Of a hundred widows with a family of children and a farm, we are sure a larger percentage will make a success in the single-handed struggle than would the same number of widowers in the same conditions. Since you are such an important factor, we do not intend that you shall be left out of our plans for helping the farmer.

In doing this, we must ask you to help us to help you. Every public speaker will tell you of the discouragements in addressing an audience when his words awaken no response. If the hearers cannot agree with him, he would prefer that they talk back than go away ignoring what he has said. In our case we want each one of you to talk back, even though you feel called upon to tell us we are wrong. We mean this in all seriousness, and hope that you will take us at our word.

The question now is, Which problem in housekeeping shall we first take up for consideration? There are so many questions that it is hard to decide where to begin. To open the acquaintance, we must choose a topic that is easy and common to the experience of all. Let us make it STEPS — THE HOUSEWIFE'S STEPS. How many do you think you take in preparing a meal and washing the dishes? Have you any idea how far you travel? Count the number to-morrow when preparing breakfast. If you cannot count the whole number, count as long as you can and guess at the rest. Then tell us how many miles you travel each day, considering that twenty-six hundred steps make a mile. As you probably prepare about a thousand meals each year, tell us how many miles of meal-travel you make. I know of some women who, I am sure, have taken steps enough to circumnavigate the globe, and are not aware that they have ever done anything remarkable. This is just the point on which we wish to arouse attention — that you are doing much more than you are aware of — and next we want to consider whether it has all been unavoidable. If we find that in many instances two steps could be made to do the work of three, there will follow a saving of thirty-three per cent — a saving which any manufacturer or merchant would seize with alacrity. I am sure you need such a saving as much as they.

I wish you would write us on this subject, for it will enable us to form an idea as to whether it is a profitable one for us to consider. However, lest you may be too tired by taking too many of these steps and cannot write, I hope you will give us your address on the enclosed card, put a one-cent stamp on the corner, and mail it. By that we shall know that you wish to hear what the others have to say.

I think you understand that there is no cost to you in all that we may do for you, as all expenses are paid by an appropriation made by the State for university extension of agriculture.

Newspaper comment, both favorable and unfavorable, followed this letter. A daily paper said it was not pedagogical to remind the farm woman that her work was hard; it was better that she should be satisfied with conditions that she probably could not change. The New York World employed a housekeeper to wear a pedometer. A Sunday edition of that journal contained a report of the result of a day's work done by this woman in a small city apartment; the number of miles that she traveled in a day was 7.38.

The reading-course.—Following the publication of the letter to the farm women and the correspondence that it called forth, a bulletin on " Saving Strength " was sent to the two thousand women who had expressed themselves as desirous of having a reading-course. That bulletin has had several editions and its subject still holds interest in many homes.

" Sanitation of the Household " was the second bulletin published. That was at a time when there was not so much thought about clean dairies and clean homes as there is now. New bulletins were issued frequently, the number depending on the amount of the yearly appropriations. Correspondence was begun with housewives in the State, who learned to use the College as a source of information and inspiration. Visits were made by the Supervisor of the Reading-Course to granges, farmers' institutes, and farm homes, where addresses on domestic subjects

were given. The printing of the bulletins continued to be irregular until October, 1911, when the College was enabled to reorganize its reading-courses; and since that time a monthly publication, called The Cornell Reading-Course for the Farm Home, has been issued.

Reading clubs.— In various sections of the State it appeared that farm women who were taking the reading-course wanted to talk with their neighbors on the subjects presented in the reading-course lessons. In some communities social opportunities were few; in others, where groups of persons had been accustomed to gather, a subject of common interest and one worthy of consideration was needed for discussion. Some wise women asked, therefore, that clubs be organized for holding meetings at regular intervals. The Department of Home Economics at Cornell University prepared a study-club bulletin giving typical programs, a constitution, and suggestions for organization. There were the usual difficulties in organization, but a number of clubs have been organized and the women are enthusiastic. Literary and domestic subjects are considered, a social hour is a part of the program, and refreshments are often served. Sometimes men and women have met together; at other times the women alone have taken up the discussion of the bulletins.

Various enterprises for rural progress bave been promoted by means of the clubs. In Oneida county there are several clubs, and in June of each year they have an all-day meeting at a central point, when the members from various sections meet for a picnic and give a program representing the work in different clubs. Members of the staff of the Department of Home Economics attend the annual meeting.

In Ballston Spa the members of the Cornell Study Club have raised sufficient money to build a hall for public entertainments. This hall is a two-story frame building in the center of a prosperous farming community, and is admirably suited to social and literary entertainments. A letter from one of the members of the club explains how the money for the building was raised:

> Pardon my delay in answering your letter, as we were just preparing for a fair which we held December 9 and 10. It was a financial success, as we cleared $103.85.
>
> You mentioned that members from other clubs wanted to know how we raised our fund. I am sure you will be interested to know that we started with $6, left over from the collection taken at our Women's Institute two years ago.
>
> We gave an apron sale, a towel sale, with suppers each time. We begged most of the material where we did our shopping. We gave several socials of various kinds. Net result, $250.
>
> We have written letters to all of our old townspeople who have left home and been successful in life, also to several ladies in adjoining towns whom we knew. This brought us about $400.
>
> We have interested some of the men enough so that they have made a house-to-house canvass of the whole community and asked for work, trees, money,— anything they could get. Net result, about $450.
>
> Last fall we had a large fair and invited the people we knew from Ballston and Schenectady, and met them at the trolley station with teams. We all worked very hard, but cleared $185.

We have been incorporated under the laws of the State of New York so we could hold property; one of our boys who is now a prosperous lawyer attended to it for us. Then we secured the services of an architect (brought up here), who gave his service. We also were fortunate enough to have a lumber dealer in the community who is letting us have his goods at cost. The foundation was built (26 x 60) in October, but the building is going on now and each carpenter hired promises one week's work free; as this is their slack time several have been willing to do so. Their time is kept by the hour.
The building has two stories: the lower floor is an audience room and stage; the second floor a library, dining-room, and kitchen.

The first Winter-Course in Home Economics.— After the reading-courses and reading clubs were successfully under way, it seemed desirable to develop further the work that the College could do for the women of the

FIG. 51.— *Staff and students of the Winter-Course of 1912–1913.*

State. Winter-courses had been organized in general agriculture, horticulture, dairy industry, and poultry husbandry. Men from the farms came to the College of Agriculture in order to learn the latest methods in farming. Some women from the farms came to attend the same lectures, but it appeared that women wanted to learn the latest methods in housekeeping — to become acquainted with scientific facts as they related to household tasks, rather than to study agricultural subjects. *They were interested in their own tasks.* It was therefore arranged that a course in home economics should be the next one in the organized series of winter-courses. The College was not ready at that time to employ regular instructors, so it drew instructors from schools in the East and the West that had already begun to teach subjects relating to home economics. In the winter

of 1906, Director Bailey announced that money was available for a course in home economics at Cornell. Probably the most unusual course ever presented in home economics was held that year in Morrill Hall. Invitations to lecture were sent to lecturers in other institutions, with the result that some of the most able women then in the field were on the lecture program of the first winter-course in home economics at Cornell University. The following program will be of interest. Many of the lecturers whose names appear on the program are still engaged in the teaching of home economics and related subjects in various institutions throughout the country:

WINTER-COURSE IN HOME ECONOMICS

1906

SCHEDULE OF LECTURES

Miss Anna Gilchrist, University of Tennessee, Knoxville, Tennessee — Economics in the farm home. January 3–9, 3 p. m., Boardman A. January 3, 10 a. m., Morrill 19.

Professor L. H. Bailey — The lawn and garden. January 3–4, 2 p. m., Boardman A.

Professor R. A. Pearson — Dairying for women. Fridays, 11 a. m., Dairy Building.

Professor James E. Rice — Poultry work for women. Mondays and Wednesdays, 12 m., Morrill.

Professor H. N. Ogden — The home site. January 5–6, 2 p. m., Boardman A.

Martha Van Rensselaer — Household equipment. January 4, 9, 12, 18, 12 m., Morrill 19.

Miss Ruth Wardall, College of Agriculture, Brookings, South Dakota — Wheat and bread-making. January 8–13, 2 p. m., Boardman A.

Mrs. H. B. Lord, Sinclairville, New Hampshire — Life on the farm. January 11, 2 p. m., Morrill 19.

Mrs. Ellen Richards, Institute of Technology, Boston, Massachusetts — Sanitation. January 11–19, 2 p. m., Boardman A. January 12, 10 a. m., Morrill 19. January 17, 10 a. m., Morrill 19.

Bryant Fleming — Municipal housekeeping. January 15–16, 3 p. m.

Mrs. Wilhelm Miller, Englewood, New Jersey — Household accounts. January 17–19, 3 p. m., Boardman A.

Miss Carrie D. Hitchcock, High School, Ithaca, New York — Cooking demonstrations. January 20, 2 p. m., and March 3, 3 p. m., High School Building.

Mrs. Albert Jones, Binghamton, New York — The Model Housekeeper. January 12, 3 p. m., Boardman A.

Miss S. Maria Elliott, Simmons College, Boston, Massachusetts — Household bacteriology. January 25, 12 m., Morrill 19. January 26–30, 3 p. m., Boardman. January 31, 10 a. m., Morrill 19.

Miss Abby Marlatt, Normal Training School, Providence, Rhode Island — Personal hygiene. January 29 and February 2, 10 a. m., January 30, 12 m., Morrill 19. January 31 and February 3, 2 p. m., Boardman A.

Mrs. Alice P. Norton, Chicago University, Chicago, Illinois — Foods. January 29 and February 3, 2 p. m., Boardman A.

Mrs. S. H. Gage — Physiology. February 2–3, 3 p. m., Stimson Hall.

Mrs. Anna B. Comstock — The farm library. Tuesdays and Thursdays in February, 12 m., Morrill 19.

Miss Marion Talbot, Dean of Women, Chicago University — Sanitation. January 22–27, 2 p. m., Boardman A. January 23, 12 m., Morrill 19.

Miss Anna Barrows, Boston, Massachusetts — Demonstrations in cooking. January 22–25, 3 p. m., Boardman A. January 24, 10 a. m., Morrill 19.

Mrs. Mary Schenck Woolman, Teachers' College, New York City — Household arts. February 5–10, 2 p. m., Boardman A.

Mrs. Emily Bishop, Mechanics Institute, Rochester, New York — Health culture for home-makers. February 5–10, 3 p. m.

John Craig — Gardening for women. February 5, 7, 9, 10, 9 a. m.

Mrs. Mary D. Chambers, James Milliken University, Decatur, Illinois — Food in its relation to infancy, sickness, and old age. February 12–16, 2 p. m., Boardman A.

Miss Gracia L. Rice, State Instructor in Drawing, Albany, New York — Home and personal decoration. February 12–15 and 18–23, 3 p. m., Morrill 12.

Miss Helen Kinne, Teachers' College, New York City — Household management. February 19–24, 2 p. m., Boardman A.

C. A. Martin — Construction of the house. February 24 and 26, 2 p. m., Boardman A.

Mrs. Mollie McClaughney Allen, Hannibal, New York — Outdoor work for women. February 26–28, 3 p. m., Boardman A.

Mrs. Helen Wells, Syracuse, New York — The use of flowers in beautifying the home. February 27, 2 p. m., Boardman A.

Miss Helen Johnson, New York City — Principles of the selection and preparation of food. February 28 to March 2, 3 p. m., Boardman A.

Mrs. Mary T. Monroe, Dryden, New York — A woman's experience in keeping poultry. February 28, 10 a. m., March 1, 12 m., Dairy Building.

James L. Hughes, Toronto, Canada — The family life. March 1–3, 2 p. m., Boardman A.

Miss Isabel Bevier, State University, Champaign, Illinois — Some essentials of a comfortable home. March 6–8, 2 p. m., Boardman A. March 8, 3 p. m., Boardman A.

Mrs. Anna B. Comstock. March 5 and 7, 3 p. m., Boardman A.

Mrs. Linda Hull Larned, Syracuse, New York — Entertaining and serving. March 9 and 10, 2:30 p. m.

Mrs. Mary Hinman Abel, Baltimore, Maryland — The relation of the householder to the question of safe food. March 13 and 14, 3 p. m., Boardman A.

M. V. Slingerland — Insect pests of house and garden. March 13, 14, 15, White 12.

The first courses for university credit.— The interest shown in home economics by women outside the college led to the belief that the college girl might also be interested in the subject. During the year a general course in home economics, with three hours credit, was given by Miss Van Rensselaer. The course was attended by about fifteen men and women from the College of Arts and Sciences and the College of Agriculture. Instruction was planned which would give students a practical knowledge of home-making and would prepare the way for more permanent teaching.

Development of the Department of Home Economics.— Finally, in 1907, Director Bailey announced that permission had been given by the Board of Trustees to establish a Department of Home Economics in the New York State College of Agriculture. As the first group of agricultural buildings was nearing completion the department was given rooms in the east and west ends of the fourth floor of the Main Building. There the department began its work. For its extension and administrative work it had three offices, together with a laboratory suitable for twenty students. Afterward a room that had been formerly used for photographic purposes was transformed into a kitchen and dining-room. Until the new Home Economics Building was available these were the accommodations. Here the Home-makers' Conference was organized, a large amount of extension work was undertaken, and a regular course in home economics was begun. Meanwhile the interest of women students and of the women of the State showed that the subject of home economics was vital to them.

The Home Economics Building.— The growth of the department soon necessitated larger quarters. A bill authorizing an appropriation of $154,000 for the construction of a new Home Economics building passed the Legislature of 1909–1910. There were delays in starting the building. On the site of the old red barn north of the Main Building of the College of Agriculture, ground was broken for the new building during the summer

of 1911. The building was first used during Farmers' Week in February, 1913. An effort had been made to complete it sufficiently for the entertainment of Farmers' Week guests. In the new cafeteria, the kitchen of which was still without sinks or steam tables, the Department of Home Economics each day served a patient crowd that reached the one-thousand mark at noon before the week was half over.

This cafeteria, which is in the basement of the building, will seat four to five hundred persons. Here students who wish to specialize in problems of caring for large numbers will have practice in providing food in quantity. While the cafeteria will provide a wholesome noonday lunch, it is intended to furnish a practical laboratory in institutional management. On the first floor are offices, classrooms, and a small living apartment. Each year senior students will have opportunity to live in the apartment in turn under the guidance of an instructor. The problem of the small household may thus be worked out in a practical way. On the second floor is a small audience room to be used for class work and for meetings relating to the work of women, particularly to that branch of the latter having to do with household economics. Food laboratories, offices, and a practice dining-room and kitchen are on this floor. On the third floor are laboratories for a study of clothing, sewing, and millinery. On the fourth floor is a large drafting room for work in house planning, furnishing, and decorating, and in designing connected with sewing and millinery.

EXTENSION WORK IN HOME ECONOMICS IN 1913

The work in extension is promoted by means of the reading-course, direct correspondence, study clubs, lectures in the State, special conferences, farm trains, extension schools, winter-courses, and home-makers' conferences.

The following figures are taken from the report for the year ending October, 1912:

Number of meetings attended, 163.

Number of addresses given, 237.

Number of demonstrations, 25.

Number of letters written, 1,987.

Number of persons enrolled in The Cornell Reading-Course for the Farm Home in April, 1913, 20,000.

Number of Cornell study clubs, 66.

Cornell study clubs.— The plan of organization and suitable programs are given in "Cornell Study Clubs," Lesson No. 13 of the Cornell Reading-Course for the Farm Home. Interest in the clubs has grown and at present there are sixty-six organizations. Housewives use the lessons of the

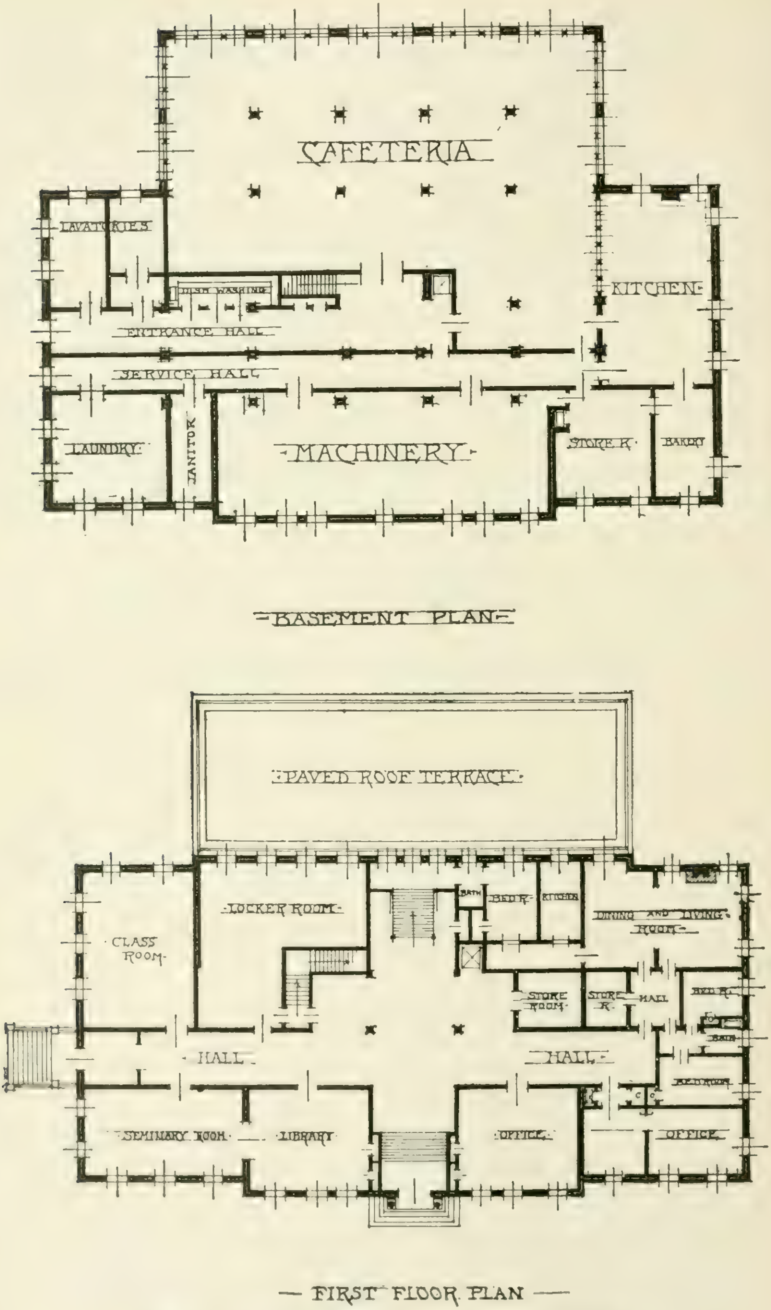

FIG. 52.— *Floor plans, Home Economics Building*

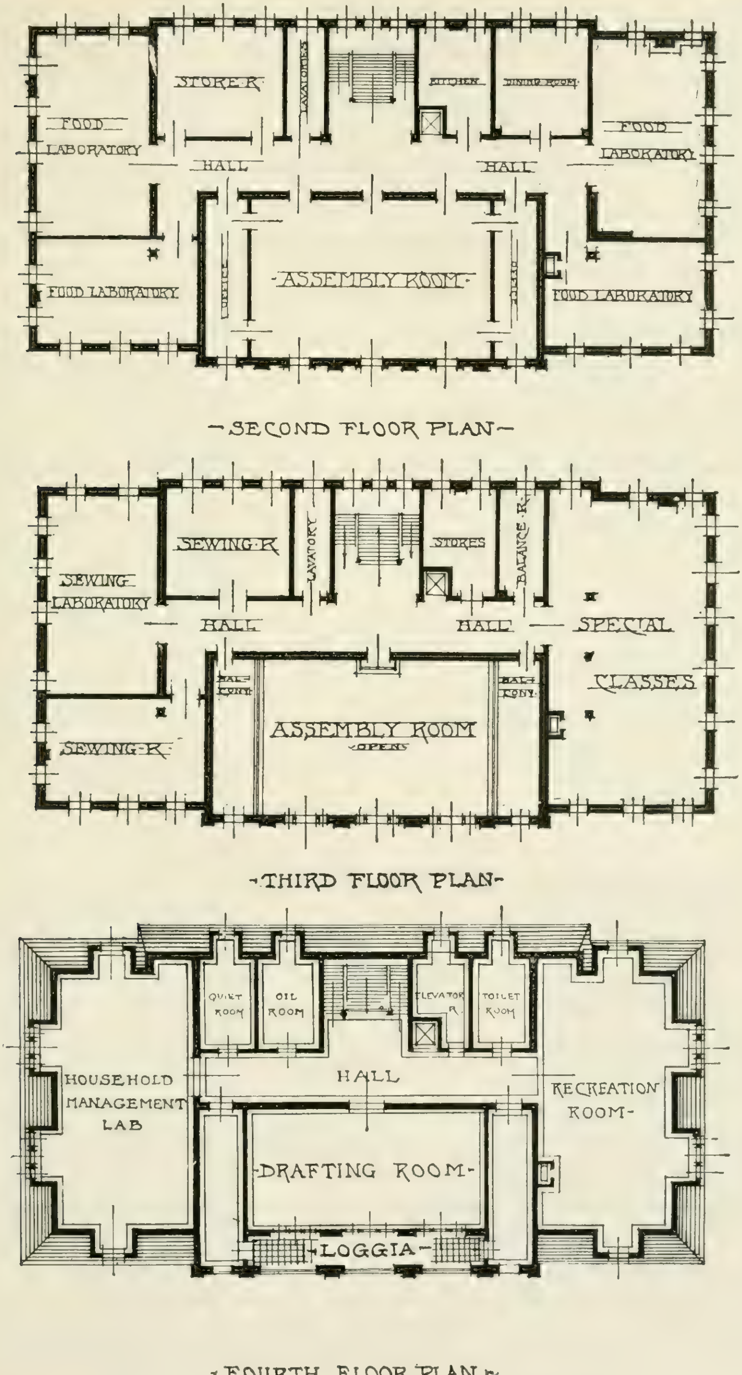

FIG. 53.— *Floor plans, Home Economics Building*

Reading-Course as the basis for a program at monthly or semi-monthly meetings. Correspondence with the Department of Home Economics is encouraged in the conducting of these clubs, and visits from some member of the college staff may occasionally be arranged.

Publications.— The first series of bulletins was known as the Cornell Reading-Course for Farmers' Wives. The bulletins were published whenever possible, publication depending on appropriations. The following is a list of the bulletins that were included in the Farmers' Wives' Reading-Course:

Saving steps	Martha Van Rensselaer
Decoration in the farm home	Martha Van Rensselaer
Practical housekeeping	Martha Van Rensselaer
Vegetable-gardening	John Craig
Flowers and the flower-garden	L. H. Bailey and others
The rural school and the farm home	Martha Van Rensselaer
Boys and girls on the farm	Martha Van Rensselaer
Reading in the farm home	Martha Van Rensselaer
Farm home industries	Martha Van Rensselaer
Insect pests of house and garden	M. V. Slingerland
Suggestions on home sanitation	Martha Van Rensselaer
Germ life in the farm home: a second talk on sanitation	Martha Van Rensselaer
Brief discussion on human nutrition	Martha Van Rensselaer
Food for the farm family	Martha Van Rensselaer
Saving strength	Emily Bishop and Martha Van Rensselaer
Programs for evenings with farmers' wives' reading clubs	Martha Van Rensselaer
Flour and bread	Anna Barrows
Dust as related to food	Martha Van Rensselaer
The selection of food	Alice Peloubet Norton
Canning and preserving	Maria S. Parloa
Suggestions to readers	Martha Van Rensselaer
Suggestions on former reading-course bulletins	Martha Van Rensselaer
Supplement to bulletin No. 2	Charles DeGarmo
Supplement to bulletins No. 2 and No. 3	Charles DeGarmo
A month of education discussion	Martha Van Rensselaer
Another study on household equipment	Martha Van Rensselaer
Human nutrition.— Part I	Flora Rose
Human nutrition.— Part II	Flora Rose

These bulletins are now out of print. Revision was needed, and several

of the bulletins have been rewritten for the new series. The new course is known as the Cornell Reading-Course for the Farm Home and is published monthly. The bulletins that have appeared thus far in the Reading-Course for the Farm Home, beginning October, 1911, are as follows:*

1.	The care and feeding of children.— Part I.	Flora Rose
3.	The care and feeding of children.— Part II.	Flora Rose
5.	Household decoration	Helen Binkerd Young
7.	Household furnishing	Helen Binkerd Young
9.	Reading in the farm home	Martha Van Rensselaer and Caroline Webster
11.	The laundry	Flora Rose
13.	Cornell study clubs	Martha Van Rensselaer and others
15.	Principles of jelly-making	N. E. Goldthwaite
17.	The preservation of food in the home.— Part I	Flora Rose
19.	The preservation of food in the home.— Part II	Flora Rose
21.	The preservation of food in the home.— Part III	Flora Rose and others
23.	Methods of cleaning	Mary Urie Watson
25.	Saving strength	Emily M. Bishop and Martha Van Rensselaer
27.	Choice and care of utensils	Ida S. Harrington
29.	Cost of food	Flora Rose
31.	Household bacteriology	Martha Van Rensselaer
33.	Vegetable-gardening	Albert E. Wilkinson
35.	The flower garden	Albert E. Wilkinson
37.	Home economics at the New York State College of Agriculture	Martha Van Rensselaer

The Home-makers' Conference.— Farmers' Week has become a regular event at the New York State College of Agriculture. Many farmers and their wives come to the College for a week in February of each year, in order to attend a course of lectures on agriculture. An increasing number of women and not a few men have become interested in the lectures on household subjects presented during Farmers' Week. At first only occasional lectures were offered on domestic subjects, but as the number of women visitors increased a Home-makers' Conference was organized similar to the conferences held in some western States. At the time of

* The even numbers, which are omitted from the following list, are used by the Cornell Reading-Course for the Farm, the series of lessons intended especially for the men.

the conference the College is astir, from front door to fields, with visitors, some coming from cities and towns, but most of them from farms. All are bent on gaining instruction and experience in their special lines. Lectures, demonstrations, and exhibitions of various kinds are offered daily in the Home Economics Building. The following is a program of the fifth annual conference, held at the New York State College of Agriculture February 11 to 15, 1913:

TUESDAY

9 a. m.	Introductory talk on foods	MISS BROWNING
10 a. m.	The boys and girls	PROFESSOR ROSE
11 a. m.	The economy and preparation of left-overs	MRS. HARRINGTON
12 m.	Septic tank for the home	PROFESSOR RILEY
2 p. m.	Demonstration, bread-making (In charge of extension class in home economics)	RURAL SCHOOL PUPILS

Girls' Glee Club

WEDNESDAY

9 a. m.	Milk in the diet	PROFESSOR ROSE
10 a. m.	Care of milk in the home	PROFESSOR ROSS
11 a. m.	The farmhouse	PROFESSOR YOUNG
12 m.	Home economics at Cornell	PROFESSOR ROSE PROFESSOR VAN RENSSELAER
2 p. m.	Carving a chicken	MISS YATES
3 p. m.	Garden flowers: what they are doing	MRS. COMSTOCK
4 p. m.	Pictures for the home	PROFESSOR BAKER
4 p. m.	Winter-course students' reunion	

THURSDAY

9 a. m.	Labor-saving in housekeeping	PROFESSOR VAN RENSSELAER
10 a. m.	Helps for home study	MISS WEBSTER MISS PARSONS
10 a. m.	Care and preservation of eggs	MR. BENJAMIN
11 a. m.	Bread-making	PROFESSOR ROSE
3 p. m.	The housewife and the cost of living	MRS. HEATH
4 p. m.	Program Cornell Study Clubs, Room 100	

FRIDAY

9 a. m.	Dressing, trussing, and carving a chicken	MR. BENJAMIN
10 a. m.	Appreciation of books	MISS MCCLOSKEY
11 a. m.	Home-made sweets, with demonstration	MRS. HARRINGTON
12 m.	Scientific management	PROFESSOR VAN RENSSELAER
2 p. m.	The art of furnishing	PROFESSOR YOUNG
3 p. m.	Entertainment	REGULAR STUDENTS

SATURDAY

9 a. m.	Household accounts	MISS FLEMING
10 a. m.	The housekeeper and the cost of living	PROFESSOR VAN RENSSELAER
11 a. m.	The relation of appetite to digestion	PROFESSOR ROSE

EXTENSION SCHOOL

In charge of Professor Dow

An extension school will be held Tuesday to Friday, inclusive. Registration will be limited to thirty-two on account of laboratory space. A lecture will be given each day at 9 a. m. and repeated at 2 p. m. by a member of the staff; this will be followed by laboratory practice. The program of work will be:

The preparation of a breakfast
The preparation of a lunch
The preparation of a dinner
Bread-making

Extension schools.— The College of Agriculture conducts extension schools in various parts of the State, in some of which a part of the program is devoted to home economics. An instructor is sent to lecture for a week on food principles and to illustrate by demonstrations; other lectures are introduced on subjects interesting and profitable to homemakers. Twenty-five or more persons are registered for the week. Equipment is furnished, some locally and some by the College, together with books and illustrative material. This is one way of bringing college work to the home.

Rural schools.— The Department of Home Economics is beginning to give assistance to rural schools in the vicinity of the University, through its extension class. This class is composed of young women, mostly seniors, who are prepared to teach. The school constitutes a laboratory for the class. A lesson in cocoa-making, egg-cooking, the making of white sauce, bread-making, or table setting and serving, is given at each visit to a rural school. Members of the class, cooperating with the rural school teacher, drive to the school, carrying with them an oil or alcohol stove, necessary utensils, and supplies for a simple lesson. One student demonstrates the making and baking of bread, another develops the geography lesson from the growing and marketing of wheat, another develops the arithmetic lesson from the recipe for making the bread. The nutritive value of the food is explained, to such an extent as is possible for the pupils to understand. This work has led to prize bread-making contests in rural schools.

State Fair exhibit.— The Department of Home Economics has had exhibits in the State Institutions Building at the State Fair, as part of the exhibit of the College of Agriculture. In September, 1912, the exhibit included prize competitions between Cornell study clubs. Each club was invited to submit three loaves of bread — one white, one graham, and one corn. Sixty loaves were submitted. The prizes were awarded as follows: to the Richmondville club, for white bread; to the Yorkshire club, for graham bread; to the Worcester club, for corn bread. In the competition the loaves of bread were made in accordance with certain specifications furnished by the Department, and a score card was used in judging the bread according to flavor, taste, odor, texture, and form of loaf.

A prize was given also for the most desirable work-dress. Of the thirteen dresses submitted, that exhibited by the Fredonia club was judged to be the best.

Winter-Course.— The winter-courses given in the College are business and occupational courses rather than academic. There are no entrance examinations, but the student should be sure that he or she is prepared

to receive the instruction and should have a good common-school education as a basis for the work. The courses are open to men and women of eighteen years of age. There is no limit of age above eighteen and the course has been attended both by young women and by some older women. Many of the latter, mature in experience, have brought much inspiration and help to the Department.

The required subjects in the Winter-Course in Home Economics are:

Foods.—This includes a study of food composition, food values, methods of selection, preparation, principles of nutrition, dietetics, care and feeding

FIG. 54.—*Food laboratory in the Home Economics Building*

of children. Laboratory work is given for the application of principles, and includes practice in the preparation of food and in serving.

Household Sanitation.—This includes a discussion of sanitary conditions of the house and site; of conditions promoting health; of proper care of the sick; and of the relation of bacteriology to the household.

Household Management.—This includes a study of the family income; the cost of living; household accounts; problems of domestic service; methods of housekeeping; equipment; marketing.

Sewing and Drafting.—This is given with laboratory work and includes instruction in sewing, and in cutting and fitting garments.

Art in the Home.— This course considers the development of more artistic home surroundings: the building, site, garden; the furnishing and decoration of the house; the selection of books and pictures.

Persons registered in the Winter-Course in Home Economics have opportunity to enter the courses in dairying, poultry husbandry, gardening, and extension work. In these courses practical instruction may be obtained with regard to milk and its products; the feeding, care, and marketing of poultry; care and marketing of eggs; commercial fruit-growing; floriculture; and ornamental gardening. As opportunity is offered, short-term technical courses of special interest to farm women will be added, such as canning and preserving, laundry management, dressmaking, millinery. It is hoped that as these short technical courses are developed many farm girls may find through them opportunity to engage in profitable enterprises without the necessity of leaving the farm. In short, the Department hopes to aid in standardizing activities in which women are interested.

Some of the women in the State have taken advantage of the scholarship for the winter-course students provided by the New York State Grange. There are twelve of these scholarships, each $50 in cash, to be awarded to men and women who obtain the highest standard on competitive examination. The awards are made in summer. Candidates apply to the Master of the Pomona Grange in their home counties, or to the deputy in counties that have no Pomona.

HOME ECONOMICS COURSES IN 1913

Instruction in home economics in the New York State College of Agriculture is now organized as a four-years college course leading to the degree of bachelor of science. Practically the same requirements for entrance are exacted as for other full college courses given in Cornell University. Instruction for the first two years includes the same underlying science courses as are required in the general course in agriculture — chemistry, physics, biology, botany, physiology, and bacteriology. The course includes also drawing, English, and political science, and affords opportunity for electing certain subjects from either the College of Agriculture or other colleges in accordance with the interests of the student. In the last two years much of the student's time is spent in the study of foods and nutrition, sanitation, household management, house furnishing and house decorating, design, sewing, and millinery. Both the theoretical and the practical are included in the course.

The course of study.— The course of study followed by students in home economics is related to various other branches. The description here given, although meager, is a general outline of the four-years course:

Freshman courses

English.— A study of representative works in English literature, including three plays of Shakespeare, five modern novels, and selected lyrics and essays. Practice in composition in connection with the reading, with incidental study of the principles of writing.

Introductory Inorganic Chemistry.

Chemistry. Qualitative and Quantitative Analysis.— Qualitative work: the properties and reactions of the common elements and acids and their detection in various liquid and solid mixtures.

FIG. 55.— *Hall, first floor of Home Economics Building*

Quantitative work: the preparation and use of volumetric solutions and work in elementary gravimetric analysis.

Biology.— This is an elementary course designed to acquaint the general student with the main ideas of biology through selected practical studies of the phenomena on which biological principles are based. Both lectures and laboratory work deal with such topics as: the interdependence of organisms, the simpler organisms, organization and phylogeny, oogenesis and ontogeny, heredity and variation, natural selection and adaptation, segregation and mutation, the life cycle, metamorphosis and regeneration, and the responsive life of organisms.

Field of Home Economics.— A course to establish in the mind of the student the relation of home economics to the sciences and arts; its significance in home-making, professional life, and technical lines of activity.

The Farm.— This is a course in the study of our agricultural environment. The Cornell University farm is explored. Its history, its topography, its population, and its chief crops, wild and cultivated, are studied. Its fields, hills, woods, and streams are explored, and records are made of the things observed.

The course deals with the sources of agriculture. It considers crops from the naturalist's viewpoint — Nature's cereals and fruits and roots and fowls that were all present before agriculture developed. Wild products are compared with cultivated varieties, and the related forms that have not been brought into cultivation are not overlooked. Finally, these things are viewed collectively, as conditioning the human affairs of the country community. They are considered as elements that may be contributory to the beauty, the healthfulness, and the intellectual interest and enjoyment of the farm home.

Sophomore courses

Introductory Experimental Physics.

Physiology.— For students who expect to teach physiology in the secondary schools, and an introductory course for students of the biological sciences. A general review of the functions of the systems and organs of the human body, with introductory remarks on structure. The lectures are fully illustrated by experiments, lantern slides, and diagrams, and periodical quizzes and examinations are given.

Foods.— A course for establishing a fundamental knowledge of foods. The lectures include a discussion of the composition and characteristics of foodstuffs; principles of selecting foods and methods of preparing them; food preservation; comparative nutritive and economic values of various food combinations. Laboratory practice is given to apply scientific principles to food preparation.

Household Chemistry.

Bacteriology.— This course considers the nature of bacteria and methods of studying them; the relation of bacteria to air and to water, milk, and other foods; canning and preserving; molds and yeasts in their relation to household problems; decay of fruits; house sanitation.

Sanitation.— The lectures in this course include consideration of the sanitary conditions of the house and site; conditions for health and care of the sick; the relation of bacteriology to the household in cleaning, in the preservation of foods, in disease, and in disinfection; heat, light, ventilation, and disposal of refuse.

Junior courses

Organic Chemistry.

House-planning.— This course aims to develop in its students an understanding of good house-planning and of good design, in order that they may have intelligent standards of judgment on the housing problem. Besides the drawing of plans, the course includes discussions of various types of dwellings, of the house and its site, of building material, cost, color schemes, constructive features, entrances, porches, and the like. Special attention is given to kitchen and pantry arrangements.

Household Art.— A course for the development of artistic expression in the individual. The lectures in this course apply principles of color and design to questions of interior decorating and furnishing. Students experiment with color combinations for decorative schemes, and with textile combinations for curtain stuffs, wearing apparel, and the like.

Human Nutrition.— A course for the development of a working knowledge of human nutrition. A study of methods of investigating dietary problems and of the practical means of applying scientific principles in planning family and institution dietaries; consideration of special problems of nutrition, as in infant-feeding and feeding in cases of abnormal metabolism. Laboratory work includes, as far as possible, practice in planning and preparing dietaries. An excursion of three or four days for the purpose of visiting schools and various industries may occur at the close of the spring vacation; estimated expense, ten to twelve dollars.

Drawing.— An elementary course for the development of graphic expression applicable to scientific studies. Of especial value to those who expect to enter teaching, nature-study, or biological research.

Political Science.— A general introduction to economics. This course is a prerequisite for most of the other courses in the field of political science.

Senior courses

Household Management.— This course includes a study of the family income, cost of living, household accounts, problems of domestic service, methods of housekeeping, equipment, marketing.

Institutional Management.— This course is for students in home economics who wish to choose a field of work outside of teaching, in caring for and feeding large numbers.

Woman and the Family.— This course embraces a study of woman and the family through the early ages to the present time. It treats survivals with reference to various characteristics and conditions of woman in the family and in the state. Woman's work and her industrial and economic condition are studied with reference to the home and to society.

Special Problems.— A course intended for the development of the individual student in particular lines of work. This includes a consideration of the logical methods of organizing and developing courses of study, for those intending to teach home economics. Problems of original investigation are planned for graduate students, or for undergraduate students who have proved themselves capable of undertaking such work.

Extension in Home Economics.— Principles of extension work in home economics, with special reference to rural communities; organization; material to be presented; manner of presentation; speaking; writing.

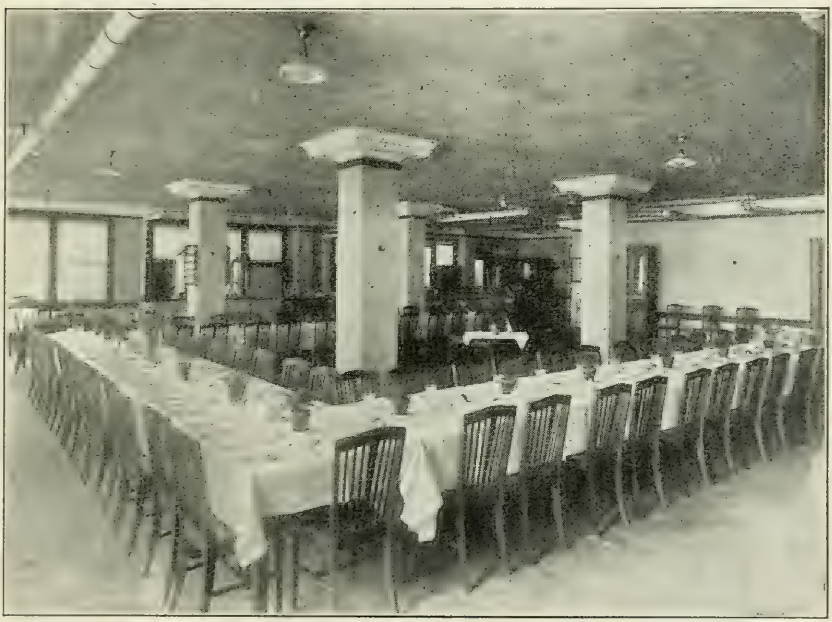

Fig. 56.— *Tables set for class banquet in the cafeteria of Home Economics Building*

Classes in designing, sewing, and millinery are to be organized during the coming year.

In addition to the above required subjects, students may elect courses in the College of Arts and Sciences or in the College of Agriculture according to the work that they intend to do in the future. Special courses are being introduced for home economics students in home-dairying, poultry husbandry, and horticulture. A proper choice of electives makes the course both technical and cultural. For example, a student especially interested in teaching might elect courses in education; another student might prefer to elect more English; still another might wish to emphasize her work in agriculture.

Application of courses to home economics.— Inquiries such as the following are received at times: "Why should physics and chemistry be a part of a course in home economics? What is the need of drawing, of political science, of biology?"

It is said that the average woman does not like physics or chemistry and is likely not to succeed in those subjects. When a woman finds that the principles of science apply to her everyday tasks, and begins to comprehend their relationship, her interest awakens not only in the science, but in the task itself. She becomes interested in physics because she is interested in the laws of light, heat, and electricity as they apply to the construction and equipment of her house. Mechanical devices for domestic work require a training in mechanical principles underlying the working of pump, vacuum cleaner, fireless cooker, kitchen range and furnace, power washers, and separators. Chemistry soon makes a strong appeal, for it renders cleaning processes, cooking, nutrition, and many other processes readily comprehensible. Biology gives knowledge of and respect for life and the laws of life. Drawing is a part of the course of study, because art is as well expressed in dress, house construction, and house-furnishing as in the making of pictures. Application of the principles of art as they apply to the home and to simple and effective clothing is to be found in a department of home economics. Political science meets the needs of the man engaged in business. Finance, corporations, tariff, railroads, municipal control, all look to economics for foundation principles; their need is recognized because of their wide financial interests. A large percentage of the family income is spent for food, shelter, and clothing. It is apparent, therefore, that a knowledge of economic principles is needed for the expenditure of that amount as well as for the earning of it.

Vocations open to students in home economics.— Until very recently it was regarded as heresy to advocate the idea that culture and skill could find an harmonious union in our educational system. The well-educated woman of a hundred years ago was the woman skilled in the performance of household tasks. Skill was the standard by which her education was measured — skill not necessarily related to culture. Industrial conditions were such that her ability to do well the practical task made her work of economic importance, and she earned her living in the home in a manner that had the sanction of the times.

In the course of events the keynote in education changed. Skill ceased to be the all-important consideration and so-called culture became the dominant factor. The value of skill was depreciated, and culture, detached and unrelated to anything practical, governed all teaching. Higher education no longer concerned itself with instructing women in practical

things when cultural training had become so compelling. Industrial conditions had changed so that skill in household affairs did not equip the well-educated woman to earn a living in a manner that had the sanction of society. The home no longer offered professional opportunities and women had ceased to be considered of great economic importance. Yet to earn a living was still the human problem. As a result, the well-educated woman of yesterday, justifying her economic existence by her skill in performing household tasks, was supplanted by the modern woman versed in cultural subjects only. She earned her living by teaching, the only profession for which the college or school especially fitted her.

But the hour has struck when culture and skill are no longer regarded as incompatible, detached ideals in education, one the antithesis of the other. We have awakened to a realization that when science and art are applied they lose nothing in cultural value and gain much in human interest. Important tasks that have been stigmatized as menial have thus been lifted to a high cultural plane. New vocations and professions are being developed through this type of education, and woman is beginning to find her field of professional opportunity greatly enlarged. Fate has here played one of her ironic tricks, and the woman of to-day in search of a profession may find herself engaged in the old household tasks which have merely been given a different name and a new setting. Once these tasks were dull; but now, through the glory that applied science and art sheds about them, they have been reclaimed from a menial position.

The purpose of home economics is to develop and redirect woman's work, to train her for what may now be regarded as the profession of home-making, and at the same time to give full consideration to her probable need of earning a living. That purpose is accomplished through a broad general training in all home economics subjects, with specialization in one. Although many of its possibilities are still in the speculative stage, the present development of home economics is such as to afford a variety of professional opportunities:

1. Teaching.— The teaching of home economics subjects is, and probably will always be, the profession chosen by the larger number of graduates in home economics. A broad field of specialization is open to them, and since more difficult and systematic training is required of specialists their financial rewards are usually greater. At present the demand for teachers of home economics is greater than the supply.

2. Institutional management.— The woman who has executive ability may enter the newly opened field of institutional management. The capable, well-trained woman may find a large opportunity for success as a dietitian in a hospital, sanitarium, or public institution, or as purveyor, steward, manager, or matron of a dormitory, hospital, or hotel.

More and more the public is feeling the need of applying scientific methods in places where numbers are being housed and fed. Perhaps this is, next after teaching, the best opening for graduates in home economics. It is a field that should not be entered without thorough consideration, for already the inrush of the over-confident and inefficient has been detrimental. Only a woman of force and executive ability, one who is clear-sighted and self-controlled and who has some understanding of human nature, should attempt specialization in this line of work. For

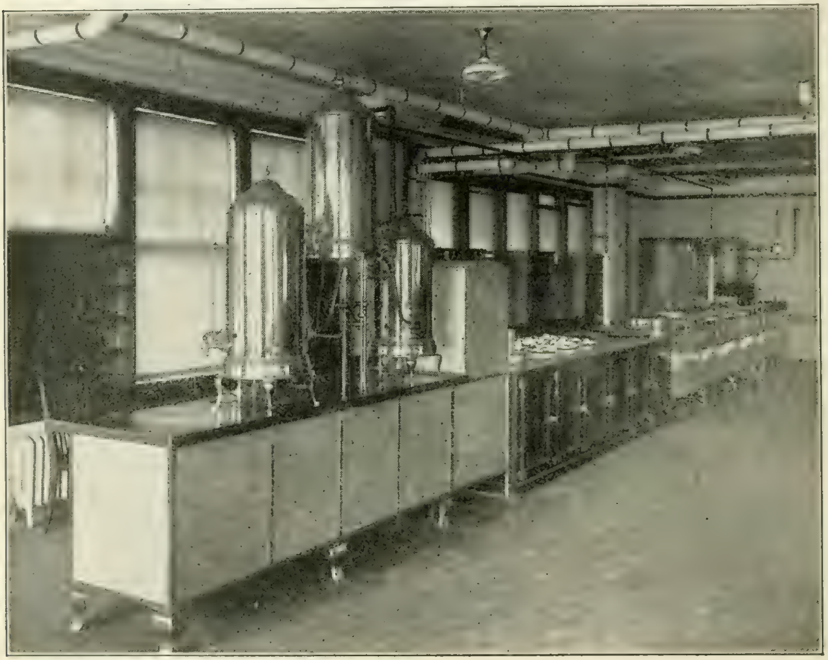

FIG. 57.— *Serving table in cafeteria of Home Economics Building*

such a woman the promise of a successful future is greater than that afforded by teaching.

3. Business enterprise.— Business enterprise in which home economics is practically applied has already been sufficiently developed to show that it has varied, original, and undoubtedly promising possibilities. Tea-rooms, lunch-rooms, cafeterias, small hotels, and inns have been opened and successfully managed by women. The woman untrained in home economics has sometimes been successful, but training, in this as in every other business, is a more direct road to success.

The baking industry offers twofold opportunities: first, as a possible commercial enterprise; second, as a laboratory for the scientific worker.

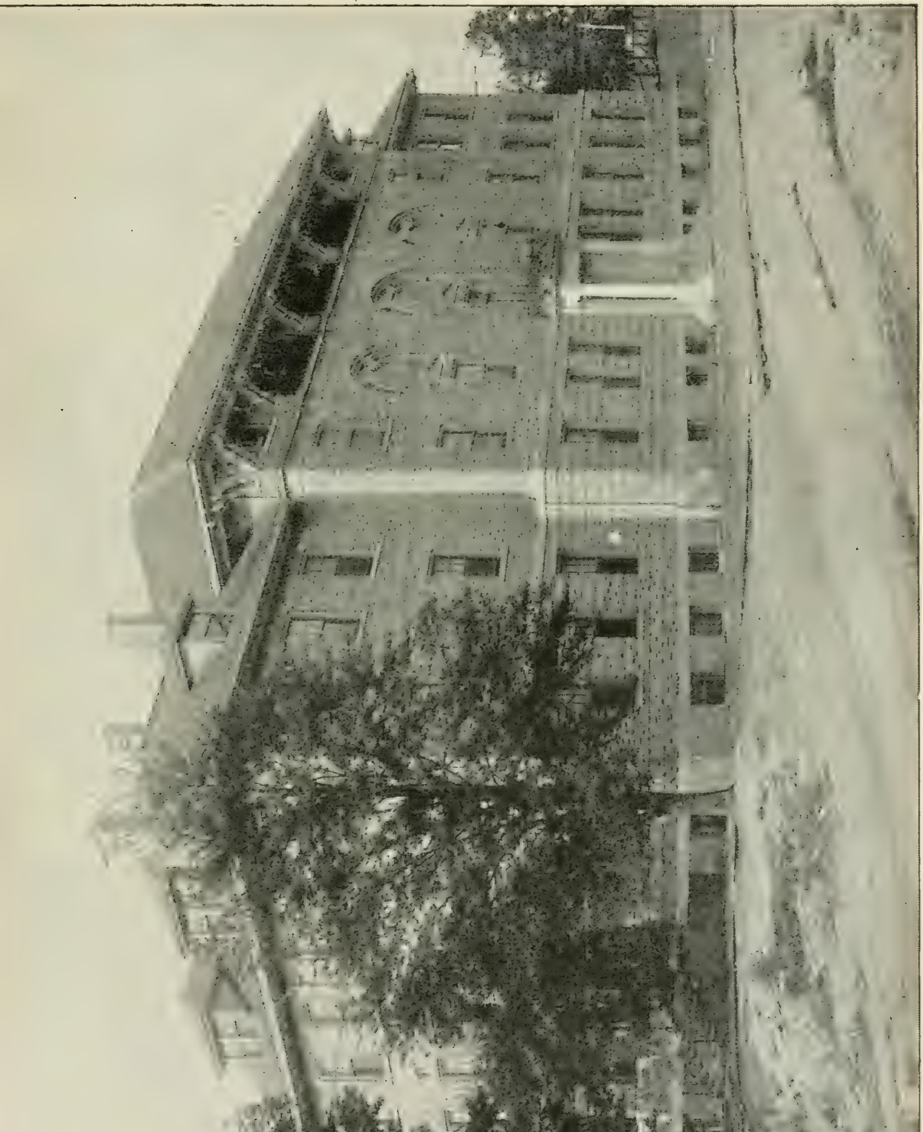

FIG. 58.— *The new Home Economics Building, Cornell University*

Laundry management, already successfully undertaken by women, promises good professional opportunities. Both the centralized bakery and the centralized laundry may be regarded as possible solutions for some of the present-day rural problems. The right woman, well trained in home economics, should find in either an excellent field for work.

Fruit-canning as an industry is promising. Women capable of directing large enterprises have already proved its possibilities. This industry has also been begun in a modest way on certain farms. In many cases it would afford at least as good an income as could be obtained by teaching.

4. Inspectors.— Inspection of food and of markets is increasing and women have already entered this field.

5. Purchasing agents.—Expert buyers of fabrics, textiles, clothing, and house-furnishings are already in demand. A course in home economics should enable an alert woman to be successful in this field.

6. Designing.— Artistic millinery, expert costuming, and costume-designing should offer great possibilities to the artistic woman of practical inclination. A knowledge of dressmaking and millinery should afford many a girl an opportunity to remain in the country and at the same time to earn money.

7. Research work.— The laboratory affords a growing field for the scientific woman desiring neither to teach nor to be thrown where executive ability has commercial value.

8. Care of children.— Expert care of children is in demand. The realization is growing that an untrained person is not competent to care for a child. The future must see women cultured and refined, versed in the psychology of childhood, and understanding the physical needs of the child, in positions of trust and responsibility.

9. Modern philanthropy.— In no other field than this is there greater need of scientific knowledge and of tact in applying such knowledge. The woman who is able to combine the two qualifications will be invaluable in philanthropic work.

10. Care of the individual home.— Last, but not least, is the profession of home-making. It is no longer sufficient for the woman who is to assume the responsibility of a household to know something of everything save the problems over which she is to spend a good part of her life. A knowledge of nutrition, of sanitation, of the care of the child, may not increase her wage-earning capacity in the home where she is wife and mother; but the welfare of the family, the benefits of their increased efficiency, are worthy of her best effort.

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

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THE FARMHOUSE *

HELEN BINKERD YOUNG

The redirection of country life implies not only better farming conditions, but also better homes. Health and happiness in the home are not marketable commodities; and yet, if estimated through a term of years, real profit would accrue from such household investment as would insure more comfortable living conditions and a healthier population. Many rural houses represent an investment of that kind; many more are in need of a fundamental remodeling. Such remodeling is often delayed because the owner does not understand how to set about his improvements.

FIG. 59.— *For the main entrance to the house a little genuine design should be afforded*

In the near future, many new farmhouses will be built. The mistakes and triumphs of these structures will in their turn be passed on for the next generation to cope with or to enjoy. The present generation should therefore feel its obligation to build wisely for the future. To this end a rural community should be interested in discussing its housing problem from several viewpoints.

* The Department of Home Economics is not equipped to plan houses professionally. House-planning has been discussed primarily because it has a direct bearing on housework. The appreciation of good planning, which results from studying organized arrangements, will guide future building in an economic direction and will enable clients to state their requirements intelligently to an architect.

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NEED OF A FARM PLAN

No building can be discussed intelligently apart from its surroundings. The best placing of the farmhouse depends on the location of the barns and the outbuildings. The relation of these buildings to one another and to such considerations as sunlight, view, roadways, and garden should be carefully studied. Obviously, a general farm scheme that unites into one workable system lands, barns, and dwelling is the wisest beginning for the development of any property. Each improvement will then take its place in the final scheme, and permanent economy will result. Owners

FIG. 60.— *Perspective view of farm group, in which house, garden, orchard, lane, and farm buildings have been planned into a united scheme*

of either old or new farmsteads will profit by adhering to a simple and direct working plan for the farm grounds. The farmhouse is merely one unit of the whole farmstead.

The practical value of a working plan can hardly be over-estimated. The haphazard farm groups commonly seen bear eloquent testimony to the futility of developing property without plan. Failure to plan involves waste of money and labor; it means a continuous process of tearing down, reconstructing, and makeshift. Under all circumstances, hit-and-miss methods of work have proved unfailingly wasteful. Organized farming and organized housekeeping are the order of the day, and to this end an organized arrangement is necessary. A well-planned farmstead is more economical, more orderly, more beautiful, and more salable than one which, like Topsy, "just growed."

NEED OF A HOUSE PLAN

The floor plan may be considered as the stage of home-making over which the housewife travels in the discharge of her duties. Economy and convenience of floor space will of their own accord effect step-saving. Any woman having standards of home economy aims to do a maximum amount of work with a minimum expenditure of time and energy. To this end the areas of the house most traveled must be condensed and waste space must be eliminated. A compact arrangement will result from planning economically.

Any house, in order to be a success, must be based on a rational plan. Many poorly arranged houses may be replanned with some success, but from a patched-up scheme there rarely results as direct and forceful an arrangement as from one that has been planned correctly in the beginning. For new work, emphasis should be laid on a plan that has been thoroughly studied and definitely drawn before building operations are begun. Various household conveniences are of course necessary. If badly placed, however, they must fall short of complete success. Therefore a plan that will anticipate the best placing of each convenience is of primary importance.

FARMHOUSE PLANNING

A farmhouse is more difficult to plan than either a city or a suburban dwelling, because it must provide for so many needs. The city or the suburban house is merely a home; it is supplemented by an outside place of business and by outside markets. The farmhouse, on the other hand, must be not only a home, but also the business center and to a limited extent the store and the market. This means that, planned as compactly as may be, a farmhouse is necessarily larger in floor area than a suburban house for the same family need be. Much thought and planning are therefore required in order to arrange this larger area in such a manner that wasteful methods of work will be avoided.

Traditional types

It may truly be said that the problem of the American farmhouse is still unsolved. For the building of new, appropriate, farm dwellings, we have almost no precedent to guide us. Most of the rural houses now standing are failures as farmhouses for the reason that they were not planned for farm conditions. In fact, many of them were not planned at all. They were merely built, and built in about the following fashion: An outer shell was constructed and roofed over, the inside was divided into rooms, and somewhere a kitchen was attached. If the house became too small, more rooms were added to fit the growing needs of the family.

With each addition to the house, the kitchen retreated to the rear of the structure, where, by its very distance from the living-rooms, it confined the housewife to her post of duty. As the family decreased in numbers and helpers became few, the front part of the house was closed and home life was centered within the radius of the kitchen and its activities.

The reaction of so monotonous a life on the worker and the family is inevitable. Seen always from the same angle of vision, life appears dreary and uninteresting, and health is at length enfeebled. What a load of misery lies at the door of wasteful planning! However picturesque a rambling house may be, it either enslaves the workers or degenerates into a small inhabited area and a large closed-up area that is useless and unhealthful.

Such of these old structures as are soundly built are worth replanning and equipping with running water, electric light, sound floors, and a good heating system. Alteration should be undertaken only after the complete project has been worked out on paper; otherwise remodeling may result merely in remuddling the arrangement.

In Fig. 61 is illustrated a rambling plan of the traditional farmhouse of the upright-and-wing type previously described. The original and the remodeled arrangement are shown in A and B, respectively. The main faults of the old plan, A, are two: first, the plan is deficient in correctly located hall space; second, the distance from the kitchen to the front of the house is too great. Since a person must pass through one room in order to reach another, the whole floor virtually becomes a passageway. This condition destroys privacy, interrupts work, and entails much extra cleaning. The right amount of hall area placed in the heart of the plan would give separate entrance to each room and would save the whole house. Hall space should be regarded as the developer of the plan. It is the kernel within the shell. If the plan is compactly arranged and the hall is centrally placed, great service may be obtained from even a small allowance of hall space. The presence of five, six, or seven doors in a room indicates poor hall-planning, and therefore poor house-planning. It is well to remember that the number of doors in a room diminishes in proportion to the excellence of the plan.

In plan B there is introduced enough central hall area to give direct access to each of the rooms. The kitchen is placed centrally at the rear of this hallway. This brings the kitchen nearer the living-rooms and shortens all working distances. If the distances from the center of the kitchen to the center of each room in plans A and B are computed, it is found that the remodeled plan saves an average distance of fifteen feet per round trip over the old plan. Such a saving multiplied by days and years would in the course of a lifetime aggregate a great amount of economy.

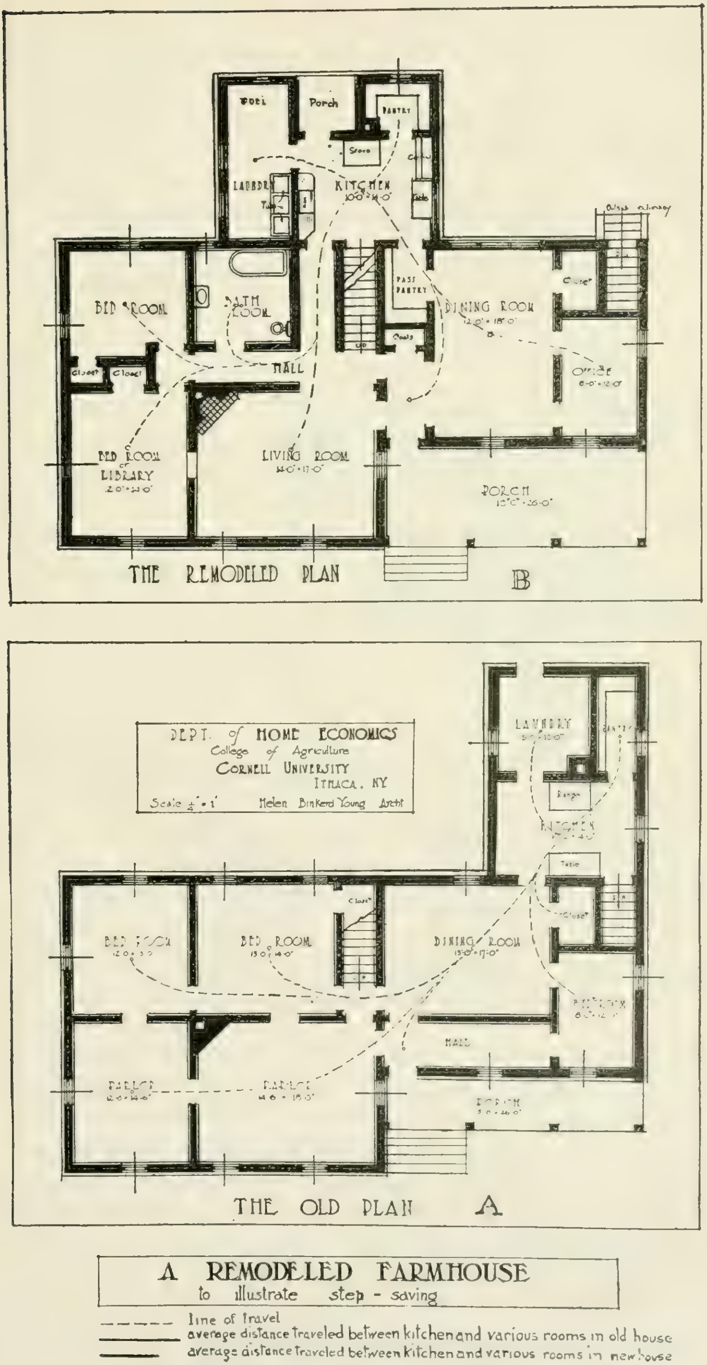

FIG. 61.— *Example of remodeled farmhouse*

In the remodeled plan, such modern improvements as heat, light, and running water have been added; closets also have been provided. The whole plan is now arranged so as to encourage wholesome living.

Under the old plan the house contained two cellars, one under the square upright and one under the kitchen, with an unexcavated area under the dining-room. A long journey was thereby involved in going from one excavated part to the other. The new plan simplified this difficulty by excavating under the dining-room wing.

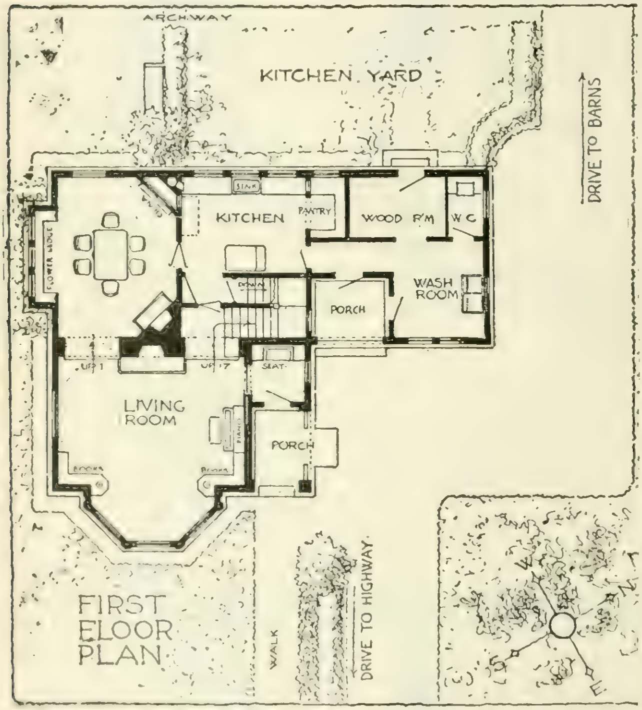

FIG. 62.— *First floor plan, showing living area and working area*

Further study of the plan is left to the individual reader.

A study of new types

Attention must now be focused on more economical arrangements. The plan of any building is based primarily on its needs. Broadly speaking, family life makes three demands on a house plan: that it shall provide living area, working area, and sleeping area. The living area refers to such parts as sitting-room, dining-room, library, office, and porch; the working area refers to kitchen, pantry, laundry, hall, and stairs; the sleeping area refers to bedrooms and bath. It is the function of a good plan to organize these three elements into a compact arrangement, allowing each requirement an area to itself. Spaciousness must be expressed in the living area, compactness in the working area, and privacy in the sleeping area. The principles of rational house-planning are based on these three distinctions.

The farm cottage shown in Figs. 62 and 63 aptly illustrates these principles. Here we have a compact plan with its three areas clearly defined.

In the living area a feeling of spaciousness is obtained by the use of wide doorways and groups of windows through which vistas are seen indoors and out. No interior, however small in actual dimensions, need appear cramped if long vistas are planned for. Good interior design is also evident in Fig. 62. It is indicated by the balanced arrangement of the structural parts of each room. On the rear wall of the living-room is seen a central fireplace flanked by broad doorways of equal width, while the front wall opposite expands into a generous bay window centrally placed, with built-in bookshelves to right and left. These features so unite as to make of the living-room a composition at once so dignified, so orderly, and so effective that little furniture is needed to complete it. In the dining-room balanced design is expressed by the long, flower-box, bay window and by the central door on the opposite wall, flanked by diagonal corner features of equal width. In general, diagonal corners should be avoided except where they are a practical necessity or where they are deliberately used for reasons of design, as in Fig. 64.

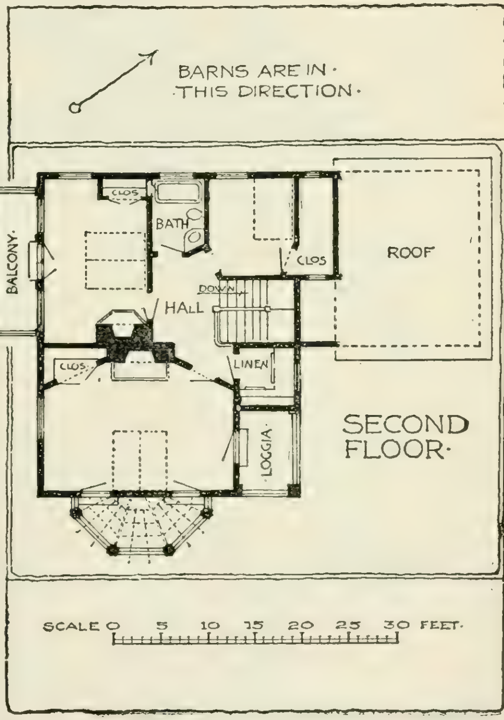

FIG. 63.— *Second floor plan, showing sleeping area*

Of the working area (Fig. 62) the kitchen, pantry, and stairs are the parts most constantly used by the woman of the house. Hence they are compactly grouped and are placed next to the living space. Woodroom and washroom are of intermittent use to the housewife but of constant use to the farmer. Consequently they are placed away from the living-rooms in the direction of driveway and barns.

The sleeping area provides one bathroom and three bedrooms, each of the latter with its closet. Their position on the second floor renders them quiet and private.

Briefly stated, economy of plan is expressed in the grouped chimney

arrangement, in the condensed hall and stair arrangement, and in the small kitchen. The kitchen arrangement is weak, however, in some respects. It has only one outside wall and is therefore lacking in cross ventilation. Moreover, the position of the door between dining-room

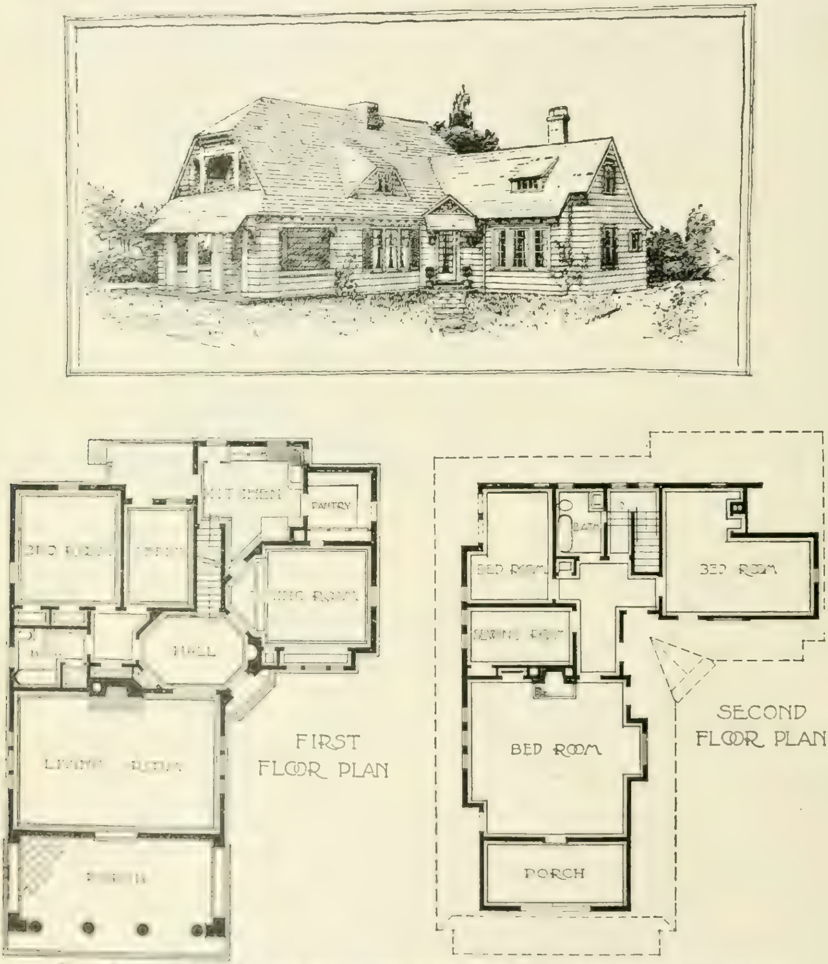

FIG. 64.—*A farmhouse plan, showing diagonal corners used deliberately for purpose of design*

and kitchen, being in line with the kitchen range, would surely prove a nuisance from considerations of sight, sound, and smell. It is unfortunate, too, that the path of travel from the rear to the front of the house leads through the kitchen.

In Fig. 65 is represented another well-planned farmhouse. It is characterized chiefly by the simplicity of the living area and by the com-

pleteness of the working area. Each area occupies about one half of the floor plan.

The living area is unique and spacious. Instead of two separate rooms, each of which would be small, living-room and dining-room are combined into one large apartment. A group of three glass doors connects this generous living-room with an unusual porch arrangement, called on the plan an "arbored terrace." This terrace, which is cement-paved under foot and vine-covered overhead, is in reality an open-air continuation of the living-room, which adds materially to the comfort of the family in summer. Here meals may be served while sunlight and garden are enjoyed. The position of window groups on both ends of the large room creates a long, unbroken vista, so that all the living space is appreciated all the time.

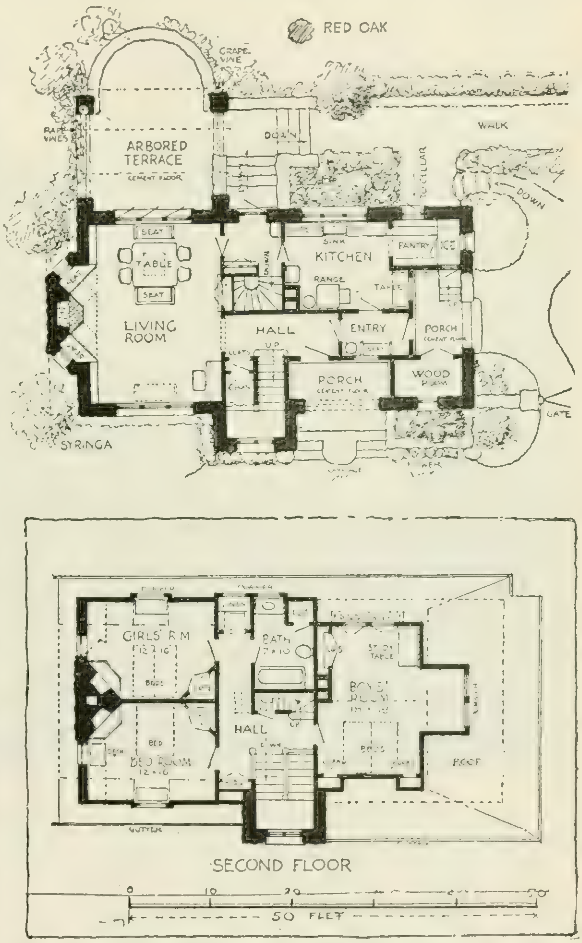

FIG. 65.— *Plan showing simplicity of living area and completeness of working area*

Centrally placed on the long outer wall of the living-room is a fireplace alcove, or inglenook. This feature increases the actual width of the room and provides two outdoor vistas in new directions. Inglenooks, however, should be used with great reserve unless they are generous in width and develop naturally on the plan. Many times the excellence of an entire plan is sacrificed to the use of a feature of this nature.

The completeness of the working area is best appreciated by observing

that each kind of work has its allotted place. The kitchen is intended for cooking; the pantry, for food storage; the pass pantry, for dishes; the woodroom, for fuel; the hall and stairs, for passage; the two recessed porches gather entrance to the house in a common passage that serves all rooms.

The kitchen arrangement shown in Fig. 65 excels that in Fig. 62 in at least three particulars. The introduction of a pass pantry serves to seclude the kitchen from the living-room; good cross-ventilation takes place

FIG. 66.— *A dignified plaster house, with simple roof lines and an orderly arrangement of similar windows. This house is set almost level with the ground, and shows a brick-paved terrace joining two small porches. A generous area is built around cellar windows, as shown at the right*

between the windows over table and sink; and the path of travel from the rear porch to the front of the house does not cross the kitchen.

In this house the laundry is located in the basement, which stands out of ground on the kitchen corner. An outside door enters the cellar on grade level.

The bedroom plan is compact, private, light, and airy.

The plan shown in Fig. 65 is teeming with personality. It speaks eloquently of the individual family and of the individual site. The arrangement of walks, shrubs, hedges, and flowers, the variations in

yard levels suggested by short flights of steps, the sunny position and unconventional treatment of the living space, together with the perfection of the working space, all testify to an industrious and joyous home life founded on a love of freedom, sunshine, fresh air, and the great outdoors.

Other plans may be analyzed in a similar manner, the strength and the weakness of various arrangements may be noted, and a sense of good planning may be acquired. The larger farmhouse shown in Fig. 67 has been inserted for personal study on the part of the readers. It represents a well-organized arrangement with a new feature introduced in

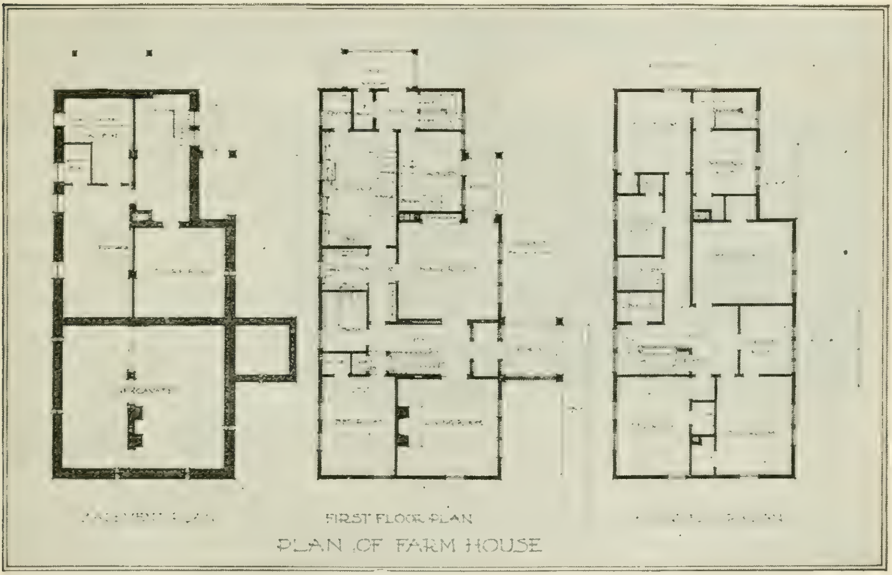

FIG. 67.— *Plan showing well-organized arrangement*

the rear — a hired man's room with separate stairs leading to it. The dignified, simple, and well-designed exterior shown in Fig. 66 will stimulate the imagination and serve to make the plan more realistic.

It must not be supposed that the plans shown in Figs. 62, 64, and 65 are perfect in every respect. No business office is included and they contain fewer bedrooms than farmhouses of the past have provided. It must be remembered that each of these houses was designed for a particular family and for a particular farm site, as all successful houses should be. Consequently they are not intended as models to be copied, but as illustrations of the principles of house-planning. If the principles of planning are understood they may be applied, whether to new work or to alterations.

In general, an intricate or confused plan is always a poor one; the more carefully an arrangement is studied, the simpler it should become. Briefly stated, the final test of a good plan is its extreme simplicity. Starting at the main entrance, one should be able to proceed mentally through the plan with ease and comprehension. For the most part the walls should be in continuous, straight lines and should show an absence of jogs, angles, and diagonal corners. Windows may be grouped or single, but should be disposed in an orderly manner with relation both to interior and to exterior appearance.

The plans shown in Figs. 62, 64, and 65 are a reasonable protest against the old wasteful types of farm dwellings. Our study of these plans will serve to show in what respects the modern rural house should differ from former arrangements. A living-room now combines the unused parlor and the over-used sitting-room into a large room for general family life; an office where the farmer's business is transacted is provided in a place convenient to roadway and barn, but outside the path of housework travel; the kitchen arrangement is compact and well organized; the downstairs bedrooms (where these still occur) open, not from other rooms, but from a private hall, thus insuring quiet and privacy (Figs. 61B and 64); a bathroom is provided on either the first or the second floor, according to water pressure; if possible all the bedrooms are provided with windows on two sides; the large hall with open stairs has given way to a more condensed arrangement; a generous porch or uncovered terrace is placed where it either commands the best view or is most useful during the day; the family hearth has literally returned in the living-room fireplace; and the whole plan is so arranged that the rooms lived in most are the sunniest.

FIG. 68.—*A farmhouse of low, pleasing mass, appropriate to flat or rolling country*

A dwelling combining the above features is illustrated in Figs. 68 and 69. Wisely studied and frankly arranged, without a foot of waste room, this structure represents a type of farmhouse that is economical to build, to heat, and to work. The stairs for the whole house are contained in one vertical shaft; the hall is reduced to a small area; an office is placed near the roadway and away from the housewife's work, which is accom-

modated in a dining-room and kitchen combination; a man's room is provided at the extreme end of the plan, away from the family; a washroom is provided on the line of travel between the back porch and the dining-room; and a spacious living-room, with fireplace and window groups, is located on a desirable corner. On the second floor,

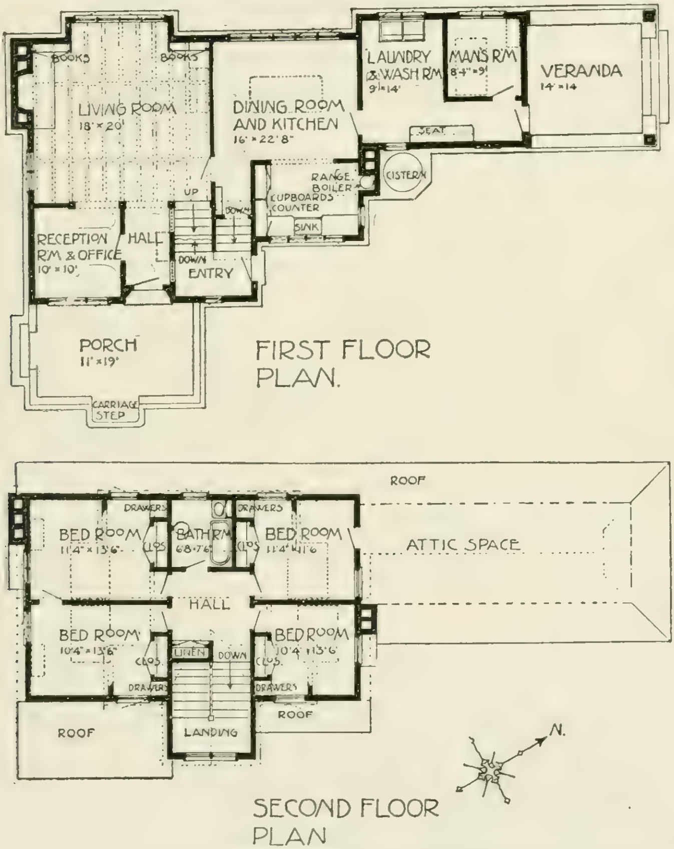

FIG. 69.— *A house planned frankly for farm life and farm conditions*

the stairs land centrally in a square hall, which gives direct entrance to each of the four bedrooms and to the bathroom; the bedrooms are provided with good closets; light and ventilation are everywhere abundant.

One feels that in this house the welfare of both the man and the woman have been equally considered. Here a family could live a well-ordered, thrifty life, with enough free time for the enjoyment of books, fireside, and friends.

The kitchen

The kitchen is the working center of the working area. It is the crux of the farmhouse. Labor economy will be in direct proportion to the excellence of the kitchen arrangements, and this excellence depends on a rational understanding of the function of a kitchen.

Function of the kitchen.— From the modern viewpoint, a kitchen is a scrupulously clean room, intended for operations relating to foods — and for this purpose only. Formerly, besides being used for cooking food and washing utensils, the large kitchen was used for eating, for washing and ironing clothes, for washing hands, combing hair, shaving, removing boots and overalls, and as a passage from the back door to the front of the house. In other words, while preparing meals the worker was obliged to travel over an area that included dining-room, laundry, and passageway as well as kitchen. Such a situation is both wasteful and unclean. Not only are most of the tasks described unrelated to food, but they are really unsanitary operations in a place where food is being prepared. By taking out of the kitchen all work foreign to foods, we may have a smaller and more convenient room where work may be brisk and uninterrupted because one may reach things instead of stepping for them. Such a kitchen, together with a separate washroom, dining-room, and pantry, will furnish a cleaner and more systematic combination than the old arrangement. The readjusted area will probably cover no more ground than the former one, but the woman will not be working over all the space all the time. Common sense has rung the knell of the large kitchen.

Kitchen planning.— The actual size of a kitchen will depend chiefly on the number of workers and the amount of pantry space that is provided. Usually the area of the kitchen proper should not exceed 150 square feet. Sizes 9 x 14 feet, 10 x 12 feet, 10 x 13 feet, 10 x 14 feet, 10 x 15 feet, 11 x 11 feet, 11 x 12 feet, 11 x 13 feet, or 12 x 12 feet, will furnish sufficient area for a good farm kitchen if generous pantry space is provided in addition. In general, kitchens that are nearly square are more satisfactory than those that are long, for the reason that the average distance traveled to any given point is less. Any kitchen should be large enough to accommodate two workers if necessary.

The location of the kitchen will of course depend on the remainder of the house plan and on the location of the other rooms. For reasons of light and ventilation it should have at least two outside walls, with openings in each. When possible a kitchen should be given one northerly wall for the placing of a cold food- or storage-pantry. North, northeast, and northwest are more comfortable exposures for a kitchen than is direct south. Furthermore, southern exposures are usually at a premium for the more important living-rooms.

After the size and location of the kitchen have been decided, the placing of the openings is the next step to be considered; the location of doors especially should be given the most deliberate attention. Two explanations will clarify the door problem: First, in a small kitchen wall space is valuable for fixtures; every door cuts out three feet of wall space, so that the more doors there are, the less wall space there will be. Many old kitchens have seven or eight doors. Ordinarily four at least will be required — an outside door, a pantry door, a cellar door, and a dining-room door. By so adjusting the plan that two doors serve one purpose this number may be reduced to two or three. Second, by the placing of doors, lines of travel are established. In order to be kept clean and to be worked in economically, kitchens should be so arranged as to avoid passage across the working center. Too often the location of an outside door creates a line of travel that interferes with the business of the kitchen. In general, then, the number of doors in a kitchen should be reduced to a minimum, and the doors should be arranged, if possible, on adjacent walls, leaving two sides of uninterrupted wall space for the necessary furnishings.

Windows should be placed at least three and one half feet from the floor, thus allowing table space beneath. Range, table, and sink should be well lighted both by day and by night.

The working area of a farmhouse is represented in Fig. 70, in which the principles of kitchen-planning are clearly expressed. The relation of the kitchen to dining-room, porch, pantry, and washroom should first be noted, after which the size, location, openings, and general equipment may be studied.

This kitchen has a corner location on the plan, with the food pantry and one wall exposed in a northerly direction. The kitchen proper represents an area of one hundred and thirty square feet and the pantry an area of forty-five square feet. The number of doors has been reduced to two, which are placed adjacent so that travel from the porch occurs around a corner and not across the working center. The most direct passage from the barns lies through the washroom, as should be the case. The windows of the kitchen, which are placed high, light the working area sufficiently and provide good ventilation. Moreover, if it is needed, a complete sweep of air may be obtained from end to end by opening the two pantry doors, over either of which a transom may be built. Both these doors are glazed, in order to afford light and view. A fuel compartment is conveniently located for either kitchen or washroom. An eating porch, looking toward the garden and the sunset, occupies the corner angle between kitchen and dining-room. Kitchen and porch connect with a Dutch door, so that outdoor meals are easily served. Extra food and

extra fuel are stored in the cellar, whence they are delivered by a dumb waiter, or lift. The reader will doubtless enjoy studying at leisure the lesser details of this plan.

If for special reasons of convenience a kitchen and dining-room combination is desired, such an arrangement as is shown in Fig. 69 will prove convenient. The kitchen fixtures are here condensed and arranged in an alcove, while the dining-room occupies the opposite end of the central section of the plan. Excellent cross-ventilation is here provided. A large kitchen that must be used also for meals may sometimes be rearranged

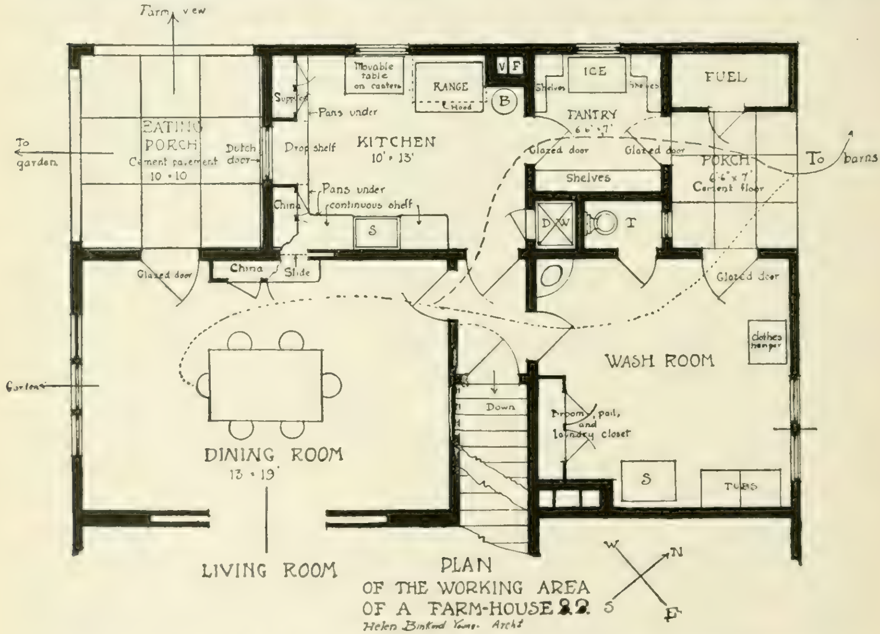

FIG. 70.— *Plan in which principles of kitchen-planning are clearly expressed*

in a similar way. The kitchen fittings may be shifted to that part of the room where stove or range must necessarily remain, while dining-room table and chairs may be grouped on the other side or end, perhaps with a china closet halfway between.

The purpose of a washroom is to save the other parts of the house. Here all dirty and occasional forms of work may be done. The room is equipped for the family washing and ironing, and stores such general cleaning apparatus as brooms, pails, and vacuum cleaner. Here, also, men coming from the barn may remove muddy boots and overalls, and may clean up before going to the table. Such feeding pails for stock as are brought to the house should be deposited here, not taken into the kitchen.

In this room, also, the children may blow soap bubbles, wash dolls' clothes, sail boats, hammer, and play at many games which delight their hearts but which create disorder in the house. Considering the nature of this room and its many uses, it should be made as large as can be afforded, and should be provided, if possible, with a cement floor and a painted wall so that splashing will not injure it. The room shown in Fig. 70 is in reality the old washhouse and woodshed fitted more completely than formerly, and is an important part of the plan.

Kitchen equipment.— The closets and working-shelf, shown in Fig. 70 are built in place. This makes a clean arrangement, as cracks behind and under the furniture are avoided. While built-in fixtures are desirable, they are by no means necessary for a good kitchen equipment. Usually they are more expensive than movable ones, unless there is a carpenter in the family who can build the desired conveniences at odd times. Extensive table space may be gained by providing generous drain boards to right and left of the sink, continuous with the cabinet shelf. A movable table of the same height, mounted on casters or, preferably, on small wheels, will prove a great step-saver and will simplify the serving of meals. A double-deck wheel tray would serve this purpose even better since it is lighter to push about. All floors on a level and all table tops on a level save many an accident in the kitchen.

A one-piece enameled iron sink, with high back, will prove a satisfactory appliance. This sink should be large enough to hold a dishpan conveniently. Dishwashing will be more quickly accomplished with the double drain board before mentioned than if a single drain board is used. Enameled iron drain boards are not advisable. They are more showy than serviceable, for, besides being noisy, they are too small to be useful and too hard to be safe for dishes. Suitable drain boards may be made of ash or of maple, or they may be made of some other wood and covered with zinc, like the rest of the table space. For the purpose of shedding water, wooden drain boards should be grooved and zinc-covered boards should be provided with a curbed or raised edge. Furthermore, a drain board should slope slightly toward the sink, on the rim of which it rests. The resulting board level is obviously about two inches above the sink level.

The construction of sink boards requires the most careful workmanship. It must be remembered that the use of wood for draining purposes subjects it to the severe test of being continually wet on one side only. In order to avoid warping and splitting, therefore, a sink board should be thick, heavy, and well cleated on the underside. A surface finish that will render the boards water-resisting should be applied before they are put into use. Usually sink boards are varnished, but this finish water-marks,

wears off, and on the whole is less serviceable than a surface finished with wood filler, followed with linseed oil.

The sink should be supported from the wall, rather than on legs, and should be piped, if possible, through a partition wall rather than through the floor. A sink should be set at a height convenient for the worker. The usual height of thirty inches to the top of the rim is too low for most persons. In a kitchen similar to the one shown in Fig. 70, the sink and continuous shelving were made thirty-five inches from the floor. This height has been found comfortable for workers five feet three inches or more in height. A worktable covered with zinc will give satisfaction, for it is nonabsorbent and is easily cleaned.

A pass slide between kitchen and dining-room will promote step-saving. Wherever there is direct communication between these two rooms, either through a slide or through a single door, care should be taken to keep the vista sightly. A double slide would doubtless help to keep odors and noise away from the dining-room.

The double china closet, with pass-slide arrangement between kitchen and dining-room (Fig. 70), is a short cut for the serving, or pass, pantry; one serves by reaching through the wall rather than by stepping through a pantry. A serving, or butler's, pantry has the advantage of retiring the kitchen from the living-rooms. As a deadener of odor and noise it is often useful in a small house, where it prevents the kitchen from becoming too intimate with the remainder of the plan. Nevertheless a pantry of this description is not always needed; although modern plans are "butler's pantried" to excess, a family may still be self-respecting without one if the problem of efficient meal-serving is solved in some other way.

A convenient food pantry with generous shelving furnishes storage space for supplies that must be kept at a lower temperature than the kitchen will allow. An ice box placed near the porch door may be filled from the pantry or may be iced from the outside if the construction of the ice box provides for it.

On the same principle that a square kitchen is more convenient than a long one, a square pantry of a given area is more satisfactory than a long, narrow pantry of the same area. Narrow shelving that will accommodate but one row of supplies will encourage neatness and rapidity of handling.

The position of the kitchen stove or range greatly affects the comfort of the workers. Whether this stove must connect with an adjacent chimney or be provided with a separate stack of its own, under no circumstances should it be placed in a dark corner or pocket of the plan. Where a new kitchen is to be built, a separate ventilating flue may be provided in addition to the smoke flue. This ventilating flue, provided

with a register inlet about four feet above the stove top, will relieve the kitchen of odors and of excessive heat, especially if a projecting metal hood is fastened over the range for collecting the rising air.

The stove or range requires more care and makes more dirt than any other feature in the kitchen. Fuel must be brought in and ashes must be removed. Usually these trips are attended by a trail of chips, dust, or cinders. Whatever can be done to simplify the incoming and the outgoing of fuel will obviously make for cleanliness and for economy of labor. A generous temporary supply may be stored either in a separate fuel compartment next to the kitchen, or in a fuel box fitted with a double-hinged cover and built into the wall in such a way that it may be filled from without and emptied from within. The actual arrangement in any case will depend on whether wood or coal is burned and whether the main supply may be stored in or near the house.

Ashes, which are a worse nuisance than unburned fuel, may be emptied directly into an air-tight metal can in the cellar. This is an easier and cleaner method than removing them by hand. A can of a size that one man can handle easily will probably not need to be emptied oftener than once a week. Many of the newer ranges are already equipped for this method of ash-disposal, but any stove may be so arranged if there is a careful workman at hand. The ash pan should first be removed from the stove and a round hole cut through the bottom of the ash compartment and through the floor below; a stovepipe is then passed through these holes and is flanged over the bottom of the ash pit of the stove. Two precautions must be observed in this piece of work: first, the stovepipe which is to lead the ashes into the cellar can must be provided with a damper near the stove, in order to prevent an upward draught of air from burning out the fire; second, a free air space of at least two inches must be allowed all around the pipe where it passes through the floor, consequently the floor hole must be cut at least four inches larger than the pipe. This open space may be filled with concrete or covered with an ordinary metal collar.

Measures should also be taken to make the ash can perfectly safe. It should be remembered that a container of hot ashes in a place not frequently visited, such as the cellar, may prove a source of danger unless it is surrounded by a wire cage or in some way protected so that rubbish, paper, kindling, or other combustible material can never be thrown directly against it.

Fortunately, the newer patterns of reliable ranges are simpler, less bulbous, and less ornate than those of the older stoves. There is less nickel-plate and flourish, and more straight line and plain surface; the stove thus presents a simpler appearance and requires less care.

Kitchen finish.— Up to the present time no perfect flooring has been invented that is cheap enough to be used in private homes. For ordinary use, however, a kitchen floor of maple or a floor covered with linoleum will be found satisfactory. These should never be varnished; in fact, no floors should be varnished, as this finish is not permanent under hard usage. It water-marks, wears off in the traveled area, and continually needs renewal. A maple floor of narrow boards filled with hot linseed oil will prove grease-resisting and cleanly. Linoleum also may be oiled and, if desired, waxed very thinly.

Kitchen woodwork should be kept plain, without grooves or moldings, and should be painted a light, pleasing color rather than stained or varnished. Wooden wainscotings in a kitchen or bath are an abomination from every viewpoint. They are not used in sanitary, up-to-date work.

Every available means should be employed to make the kitchen an attractive workshop. So surely are we all creatures of environment that there is no estimating the relief from tedium that would result if all cooking were done in truly beautiful kitchens. Because of its influence on the worker, a pleasing color effect is just as vital in the kitchen as in the living-room. Yellow, varnished woodwork and drab paint spread a drab feeling over the work and are no more practical than light painted surfaces. Light colors, such as cream, buff, or gray, which are mixed on a basis of white, are cheering, restful, and good to look at. Moreover, they reflect light and create a sense of space.

Many ways of improving kitchen conditions will develop as each person studies her problem. If the room needs fundamental rearranging, a combination of an accurately drawn plan and movable bits of cardboard to represent the furnishings will provide a helpful way of determining good results. Every woman should have access to a few views of attractive kitchens and to a few good house plans in order to stimulate her imagination and to redirect her housekeeping into fresh channels.

MODERN IMPROVEMENTS

The class of conveniences known as modern improvements — meaning thereby plumbing, heating, and lighting systems, the installation of mechanical power to be used for pumps, washing machines, mangles, vacuum cleaners, and the like — may properly be discussed only by experts who have special knowledge of them. The practical aspect of most of these improvements has been widely discussed in books and pamphlets, so that any householder may become informed before installing such improvements in the home.

EXTERIOR DESIGN

In order to be a success, a country house must be in harmony with its environment. It should appear to have grown on its site, and to be a normal expression of human life in natural surroundings. The house should be in tune with the color and the contour of the landscape. Farm lands in this State are for the most part flat or rolling, and thereby produce contours which are strongly horizontal. Architecture that is appropriate to such landscape should in general be low, broad, and snug. Tall, narrow structures are necessary in cities where land is costly and only air is cheap,

FIG. 71.— *An appropriate type of architecture for a country home*

and are appropriate in rugged, cliffy countries where nature is replete with vertical surfaces; but they are inappropriate and impertinent when standing free on a flat site.

Color scheme

The setting of a rural house presupposes such natural scenery as is composed of trees, shrubs, lawns, gardens, hills, rocks, and streams. The color effect of the house must be in harmony with this setting. Such colors as white, cream, grays, soft greens, and browns of various shades will always harmonize with nature, which clothes herself in similar garments. Red is bold unless partially screened by planting. The use of brick is about the only reason for introducing a red color scheme. Brick

walls are broken in mass by jointing and relieved by contrast at the openings, whereas a wooden house painted red is distressing. When field stone, concrete, cement, or brick is used, the color scheme is spontaneous, being produced by the color of the materials selected; when wood is used, however, a surface color effect is applied by means of stain or paint. This color scheme should be neither too dull nor too bright. Cold grays and drabs are about as cheerless as red is aggressive. In general, when choosing paint from samples it is wise to select a color that is somewhat softer than the effect desired. A small piece of gay color which looks interesting in the hand, appears glaring and bold when covering an entire house. Likewise, a cold, dead color appears cheerless when used in mass.

The chief factor to be avoided in painting houses is an effect of patchiness. In general, keep all divisions of one idea in one color or tone. For example, in the case of a porch post or column, the cap and the base should not be painted one color and the shaft another. From start to finish it is a post, and should be treated as such. In fact, the whole porch is one idea. Cornices, brackets, and moldings should not be picked out by color, as light and shade interpret them sufficiently. Useless bric-a-brac and ornament that cannot be removed should be subdued as much as possible in the color scheme.

Looked at as a picture, the windows and doors of a house should appear as decorative accents, contrasting with the background of wall. Windows especially are the eyes that give expression to the architectural face of the dwelling. With walls of a light color the windows naturally form a dark contrast; but if the walls are dark or dull in effect, the windows may be enlivened by painting the sash a lighter or brighter color and the blinds a clear shade of green, yellow-brown, or other harmonious color. Doorways and entrances should have dignified recognition in the color scheme.

General proportion

The effectiveness of a house in the landscape depends not at all on ornament, but on its structural shape and the color produced through the use of building materials. Refined proportions, simple roof lines, and interesting but not violent contrasts between roof, walls, and openings, together with the character and arrangement of windows and doors, are the elements that combine to make of a country house an example of true rural architecture.

It has been previously stated that the mass-proportion of a house in the open country should be low and broad rather than tall and narrow. This feeling of proportion depends not so much on the actual height of the house from ground to gable, as on the position of the eaves or the cornice line. When the eaves line is low the effect of the house is low; hence

the value of long roof lines in obtaining good proportions. If the roof rafters are brought down to the level of the second floor, a sound, practical, and good-looking structure usually results. It is desirable to include the porch under such a roof whenever possible, since this simplifies the roofing system of the house and unites house and porch into one contained design. While long roof lines and recessed porches are not always desirable, they have their charm and place.

Low eaves and a long roof line usually fit a farmhouse plan very con-

FIG. 72.—*A dignified, well-designed exterior showing a long roof line which covers a recessed porch. The windows show orderly arrangement, with tops on the same level. A continuous dormer window provides light and height for second-story rooms. The design of the long dormer is symmetrical with a recessed upstairs porch in the middle*

veniently for the reason that such a treatment brings a smaller second-floor plan than first-floor plan. This is exactly the farmhouse requirement. The rooms under the roof may be lighted and ventilated by means of generous dormers or gables.

It is commonly supposed that bedrooms located under a sloping roof must necessarily be low and hot. This is not true. The fact that some bedrooms so located have been stuffy does not argue that all bedrooms need to be so; it implies rather that there has been no cross-ventilation

in the objectionable rooms or that the windows were placed so low as to leave a pocket of hot air confined near the ceiling. Every one knows that hot air rises, and that it will remain until it finds an outlet. This outlet should be furnished by windows placed high in the room. If the roof pitch and dormer windows are studied to fit the height of the second-floor rooms, a full second story with high or full-length windows may be commodiously arranged under a long roof, and the low parts may be used for closets.

Structural elements

The windows of a dwelling, whether grouped or single, should be similar in style and should show some kind of orderly arrangement. In general, unity of design is preserved if the tops of all windows on a floor are kept on the same level. Variations in window heights will thus occur between the floor level and the sill. Oval windows, diamond-shaped windows, and other fancy forms should be avoided. A miscellaneous collection of windows jotted at different points over a building robs it of dignity and composure. Window blinds and small panes have a certain decorative value from the outside.

No country house is complete without a generous porch or other feature that will form a center for outdoor family life. A vine-covered arbor, a paved spot, or merely a shaded stretch of lawn near the house may be made fully as livable as the usual porch. Moreover, the re-creation of energies that takes place as one sits with feet on the grass and with rustling leaves overhead, is of a finer sort than the mere physical comfort afforded by the conventional porch. We need to experience anew the keen pleasure of living near to nature, sometimes at least.

English and German householders could teach us much concerning the enjoyment of one's own dooryard. At present we have too many back yards and too few gardens. We do not sit in our yards because they are ugly, and they are ugly because we, as a nation, are indifferent to the landscape conditions of our property.

For this neglected condition, the usual type of American porch is no doubt chiefly responsible. This porch, a covered platform attached to the house, built high and dry, enclosed by a railing, and reached by steps, has artificially confined outdoor life to the house apart from yard and garden. If comfort and beauty are both to be served, neither porch nor garden should be sacrificed; they should rather be arranged adjacently so that the lawn adjoins the porch and the vistas down the garden paths are continuous with the main vistas from the porch, or are related to views from the important windows of the house. In other words, house and grounds should be planned as one continuous design, using as a connecting link the porch, an element which is the house part of the garden and the

garden part of the house, partaking of the protection of the one and the freedom of the other.

The chief difficulty with a united porch and garden scheme arises from the usual difference in height between the porch floor and the yard level. These two levels may be brought near together either by setting the house low on the ground and building areas around the cellar windows (Fig. 66), or by raising a flat, graded terrace to within a step or two of the porch floor. Both these schemes are frequently and successfully practiced, and in no way prevent light and air from entering the cellar.

In order to be commodious, a porch should be room-shaped, rather than long and narrow. A porch ten to twelve feet wide and fourteen

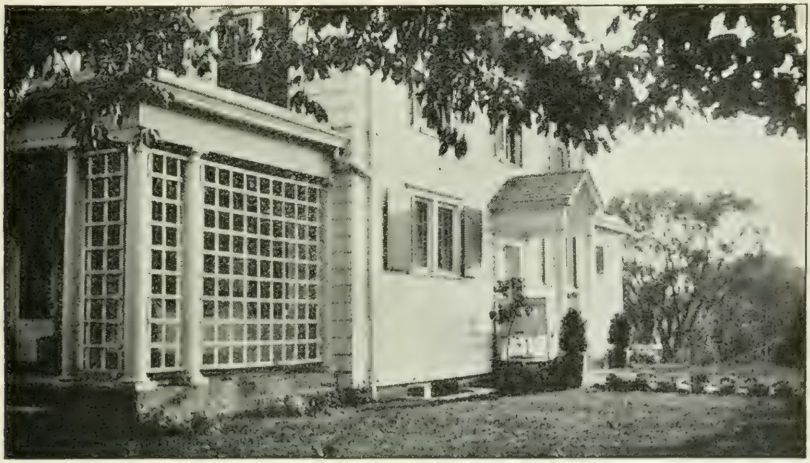

FIG. 73.— *Perspective view of a white shingle country house. The foreground shows a room-shaped porch, twelve by twenty feet, with ends covered by decorative lattice to be used for vines. Floor level two steps above grade. Porch floors with brick edge and cement body. Areas built around cellar windows*

to twenty feet long will give greater comfort than one six to eight feet wide and extending around two sides of the house. Furthermore, a rectangular porch will not darken so much of the interior as will one extending along the full length of the house. If the porch occupies a sunny position, it may be shaded and embowered by screening with lattice-work, over which vines may be allowed to grow. A cement or brick floor is desirable for porch use.

If an upstairs sleeping-porch is planned, the railing should be built solidly from the floor for two or three feet, and the open part above should be provided with window sash and awnings in order that storms and early morning light may be excluded. This arrangement can be made comfortable for year-round use and may prove a good investment as far as the health of the family is concerned.

Outside entrance doors should be sheltered by a hood on brackets, by a portico, or by a porch. It is usually desirable to separate the living-porch from the main entrance. Here, if anywhere, a little genuine design should be afforded. A portal is an intimate feature and should express dignity, hospitality, and beauty to all who enter. A natural-finish oak door with plate glass panel can hardly be considered appropriate for a decorative doorway, because it is out of keeping, both in material and color, with the remainder of the exterior.

FIG. 74.— *A hooded entrance, beneath which is an uncovered porch with built-in seats*

THE COST OF BUILDING

The more experience a person has had with building operations, the less willing is he to make definite statements on the subject of cost. The actual cost of building a given house is determined largely by local conditions. The cost of labor, the cost of materials used, the distance of the new building from the base of supplies, and the amount of hauling involved, are items that vary with every job. Thus no fixed price may be quoted as to the cost of a given building, any more than a fixed price may be quoted for eggs per dozen, the year round and in all localities. The reading public should therefore place no faith in the building figures quoted in popular magazines. They are misleading in the extreme; for they usually represent either a set of conditions which have not been fully told or which are so unusual that they may not be duplicated. In general it may safely be said that a modest house of usual construction may be built for considerably less money by rural labor than by city labor.

One way of estimating the probable cost of a new house is to compare it with another dwelling recently built in the locality. If the size and cost of the house already built are known, one may compute the average cost per cubic foot by dividing the total cost by the number of cubic feet that the house contains. If the house that is planned is to be of better grade than the one that was figured on, it will cost more per cubic

foot; if it is simpler, it will cost less. A rough estimate may thus be reached before the work is undertaken or is figured out by the contractor.

With our present standards of building it is likely that in no locality can a house with modern improvements be erected for less than twelve cents per cubic foot, and that a modest house need not exceed twenty cents per cubic foot unless fireproof construction is used. An average cost of about fifteen cents per cubic foot is probably fair for most country districts.

Much has been said and written about the present high cost of building. It is true that a house of a given size to-day often costs twice as much as one of the same size would have cost twenty-five years ago; but this advance is due not alone to the increased cost of labor and material, but also to the fact that we are not comparing similar types of dwellings. We are comparing a house equipped with heat, running water, hard-wood floors, many closets, and frequently with electric light and built-in furniture, with a mere weather-proof structure built with single floors, no closets, and few or no modern improvements Many more trades and much more equipment than formerly now go into the building of a comfortable house. It is the amount and the kind of equipment that increases the cost; a house thirty by forty feet may be made to cost three thousand dollars or ten thousand dollars, according to the beauty and finish of interior woodwork, floors, and walls, the amount of plumbing, the number and kind of fixtures selected, or the kind of heating plant installed. The interest on this increased investment must be reckoned in distinctly human terms; increased joy of living, greater comfort, finer health, and simpler housework for the women, should be sufficient return for any man who loves his home and family.

BY WAY OF ADVICE

Any person who expects to make alterations in a house should begin to ponder improvements a long time in advance. The first step should be an accurately measured record of the present floor plans, drawn at a scale of one quarter inch to the foot. The exact size and position of walls, openings, closets, chimneys, or other existing features should be located on these drawings, which may then be studied by comparing them with other good plans found in books and magazines. Tissue paper or, better still, tracing paper may then be placed over the drawings and alteration sketches freely made. A dozen arrangements may thus be tried on paper, hung on the wall, and considered at leisure. These plans should be supplemented by a building-book in which one may keep measurements, written data, and new ideas as they occur. In this book clippings may be pasted and sketches may be freely made. These

plans and this book correspond in a rude way to the architect's drawings and specifications, and will serve to crystallize the alterations into definite form.

Generations of building experience have shown that successful results must be based on definite instructions. No man's memory should be trusted for measurements or other information, and, since purse and comfort are valued, verbal directions should not be given to workmen. Building operations are exceedingly definite; walls and openings when in place cannot be budged one inch in order to suit a piece of furniture or to make way for an altered notion. All these experimental ideas should be worked out on paper; it is cheaper to erase a wall than to tear it down. To rip out a partition or pull down a chimney two or three times before it is right, is deliberate wastefulness and often represents a sum that would build a cabinet or repaper a room.

As the owner studies over alteration problems, the best arrangement will at length take shape in his own mind. An intelligent home-made drawing and an explicit written list of his requirements may then be put in shape, so that the carpenter or contractor can make a fairly accurate estimate of the cost before work is begun. In order to obtain intelligent results the owner should read up, in reliable books, such subjects as waterworks and heating systems and should freely investigate catalogues of equipment.

When the contemplated alterations are extensive and therefore costly, or when a new house must be built, the work should by all means be turned over to a good architect. Forceful arrangement and good design require trained experience; an attempt to get along without such professional help is, on the face of it, false economy. It is the architect's daily business to put building requirements into buildable shape. Practical construction is the basis of his design. Moreover, he is acquainted with all the short cuts whereby efficient results may be obtained quickly and permanently.

The chief difficulty usually lies in finding a good architect. It is frequently complained by country people that there is no architect within miles of the home place; or that the nearest one is merely a fancy carpenter who has set up for himself and whose taste is no more reliable than that of an honest workman. This is a very real dilemma, and one not easily solved.

The best course to pursue in such a case, after drafting the proposed plans as definitely as possible, would be to go on a still hunt for a good architect, taking the plans along or, better still, inviting the man selected to visit the site. The desired work should be explained to him by the owner clearly and definitely in order that relations between archi-

tect and client may be straightforward and sincere from the start. Absolute frankness on both sides will speed the work and keep down the cost.

Few persons believe that they have no right to build until professional help can be afforded; yet such a position would be well taken. Houses stand not for a month nor for a year, but for generations; by them the thrift of a community is judged, by them the ideals and taste of a community are formed. He who deliberately builds an ugly house condemns himself as a poor citizen; while he who builds a beautiful house proves himself a good citizen, for his personal effort contributes to the public welfare.

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BETTER FARMHOUSES

(Abstract from address by Director L. H. Bailey to the students of the College of Agriculture)

It is my constant reiteration that country-life affairs must be redirected. These affairs and interests are of two general kinds — those that appertain to the community as a whole and those that connect directly with the farmer's personal life and business. All country-life affairs have been inadequate as measured by their possibilities and by the expansion of civilization at large. Institutions and affairs become crystallized and stationary, and it is only by readjustment that we are to grow.

The process of redirection has actively begun in a number of country-life institutions, so that we no longer need to point out their deficiencies so much as to aid in shaping the readjustment that is now in progress. That is to say, the forces are beginning to concrete themselves and to work out a solution. This is particularly true with the colleges of agriculture, the country school, the country church, the country highway extension, and the spread of means of communication. In other avenues the redirecting forces have scarcely yet taken hold.

The farm plan and the house plan

On the side of the individual farmer, the process of redirecting his whole farm scheme is now well under way. By means of direction, aid, and sympathy, a new farm plan will work out in cases where it is needed, although it will still take considerable time.

Farming is a business system and, like other business systems, it must have a center. The center of the farm business is the residence. When we strike the farmhouse we strike the very center of rural life. It is just as much a problem to reorganize the farmhouse as it is to reorganize the farm itself.

Our farmhouses were mostly built many years ago. The older ones were adapted to a former kind of country life and to a type of farming that is gradually changing. Many of our older houses are gradually falling down. Many farmhouses are all that can be desired; but the larger part of the establishments in New York State must be either thoroughly remodeled or else rebuilt within the next forty years. It is very important, therefore, that we do not follow old lines of house planning and construction.

Of course I do not mean that the farmer is to discard his residence before such time as he desires to do so, and certainly not before he feels that his income warrants him to make a change. My point is that as fast as the farmhouses are rebuilt or reconstructed, certain new features must be incorporated into them. Neither do I mean that the farmer must build expensively. A cheap house may serve its purpose in the class of construction to which it belongs, and it is as easy to make it convenient as to make it inconvenient.

The farm scheme has been largely traditional, fields being added as the forests have been cleared; and these fields tend to remain year after year. A modern farm management obliterates all unnecessary limits and lines

and makes a new plan of the whole property. Similarly, the farmhouse has been very largely traditional in its plan and construction. A familiar type of house is the long upright-and-wing, with the kitchen at one end and the living-rooms at the farther end, and with perhaps the cellar under the upright, or parlor, necessitating much travel. Only a part of the house was warmed, so that the living was nearly all concentrated in the kitchen and in one or two rooms adjoining it. Any rambling type lacks the concentration that is needed in middle-class new houses of the present day.

The introduction of waterworks, the difficulty of obtaining household help, the expense of heating, the removal of the handling of milk from the residence in many cases, and many other changes, have made a new design of farmhouse quite as essential in many cases as a new plan of the farm itself. I think that town houses need just as much to be redirected as country houses; but I am not speaking of town problems.

There has been a tendency in recent years, when new houses are to be built in the open country, to adopt city models. The house which is narrow and high of necessity in the city, and which serves city conditions very well, not only may be very gawky and unsightly in the open country but also may entail much unnecessary labor in running up and down stairs.

What a farm residence should be

By way of concrete suggestions, I will throw my statements into classified paragraphs. These suggestions apply to common farmhouses, rather than to the estates of country gentlemen:

1. Plan a waterworks system with a supply coming from an elevated tank in the barn or in the attic, from a pneumatic tank in the cellar, from a pneumatic cistern, from a creek or a well or a spring at an elevation above the house, or from an hydraulic ram.

2. Plan a compact room arrangement that will allow a woman with two or three children to do her work without servants and also to have some time for reading and for social activity.

3. Consider how a hired man may occupy a room which has a separate entrance from the remainder of the house and yet which may be under family control.

4. Plan the addition of outdoor sleeping facilities. Add a fireplace to an old farmhouse.

5. Plan a house with an accessible and attractive back door or work entrance.

6. Plan a lighting system either by acetylene gas, electric light, or other means that are now available. Extend this system to the barns, if practicable. Also devise a way to heat the house.

7. Plan a plain workroom or retiring room for the women of the family, particularly for the wife and mother. This should be a retreat room that is free from the cares and noise of the remainder of the house, containing perhaps a few books and other means of recreation.

8. Provide an office that shall be the business nucleus of the farm scheme. This office should be of easy access on the first floor of the house, rather than in the attic or in the barn. It would be easy to add such an office to almost any farmhouse. It should have an outside entrance as well as connection with the living-rooms.

9. Figure out a system of storage rooms that will hold the family supplies and such products as need to be sold or handled from the residence assuming that the family is six persons and the place a general farm of one hundred acres.

10. Plan the simplest and most compact arrangement of rooms so as to accommodate properly a family of six persons on a farm of one hundred and fifty acres.

11. Devise a system of light power that can be applied to household work, and indicate the kinds of work that may be effected by it. The plan may contemplate a water-power outfit, a windmill, a gas or hot-air engine, or an installation through electric wires.

12. Plan a garden or a yard that shall be a real supplement to the house. I do not now have in mind so much the raising of vegetables and fruits for the household supply, as the providing of pleasant outdoor spaces for reading, sitting, dining, and the like. Every opportunity should be seized to get the farmer and his family out of doors, since contact with nature in hours of leisure will add much to the resourcefulness of their lives.

Standardized houses

We very much need standardized plans for farm dwellings. Such plans would indicate the nature of the problem, how all the parts of the residence are related to one another, to the needs of the family, and to the needs of the farm.

We are now working out standard schemes of farm management. It is not expected that any plan will be followed literally by any particular farmer; but it is possible to study the underlying principles of a farm organization that shall be economically most feasible. Similarly we ought to have such a knowledge of household necessities as will give us some rather definite working statements on the best general arrangement of rooms, the floor space per person, the size of the house in relation to the size of the farm, how large one kind of room may be with reference to another kind, the proportionate outlay that may be devoted to house and barn and to the farm. I do not have in mind the ready-made plans that we see in the public prints, but rather a set of working principles. A person should be able to apply these principles at the same time that he expresses his personal tastes and varies the plan in its details.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 39 | ITHACA, NEW YORK MAY 1, 1913 | FARM HOUSE SERIES No. 6

THE FARMHOUSE

DISCUSSION PAPER

This discussion paper may be returned with answers to the questions and with any suggestions of your own. While the answering of these questions is not absolutely necessary, much greater benefit will be derived if you give to others the benefit of your own experience. It will also help us to understand your point of view. The lesson may be used in the grange and in the club where these subjects are considered.

1. What are the most common mistakes of arrangement in the houses of your locality?

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2. Judged from your own experience, what size and shape of kitchen proves most satisfactory?

3. Have you running water in your house? What is its source? By what power is the supply made available?

4. What do you consider the best location for the family laundry?

5. In work so permanent as building, do you consider that a limited saving of money justifies the time and the energy wasted daily in a poor workshop?

Name..............................

Address..............................

Date........................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

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RULES FOR PLANNING THE FAMILY DIETARY

FLORA ROSE

"What shall I have for dinner?" asks the housekeeper; and we might add, "and for supper and for breakfast?" Three meals a day, each day in the year! Do we wonder that this is a perplexing problem? Yet consider the importance of its right solution! Like other animals we are largely the product of two factors, inheritance and food supply. If our ability to live an efficient life is therefore at stake, the planning of meals is indeed an important charge which should be attended to in no uncertain and haphazard manner.

Particularly is care necessary in the dietary of the growing child. Vigorous growth and development are his due, and we should see that his choice of food is wisely guided and that proper foods, well prepared, are set before him. The adult members of the family may have sufficiently weathered the years of poor nourishment to struggle along; but the next generation should be better equipped than the present one. In response to right care the human being is not unlike the automobile. If the automobile is well made and its needs are intelligently supplied, it goes humming along the road and steadily mounts the hills with all its intended power at instant command. Distance vanishes before it and its accomplishment is great and sure. If the machinery becomes clogged and fails to supply the required energy, the smooth running is disturbed, the hill is hard, the shortest distance becomes too great.

And so it is with man. If his road is to be traveled and his hills are to be climbed in the fullness of his powers, his physical needs must be understood and satisfied. If the human engine is poorly fed and is not well cared for, it responds to its task no better than does the poorly supplied and badly-cared-for automobile.

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MEAL-PLANNING

Although the best type of meal-planning must be based on a thorough knowledge of human nutrition, much may be accomplished by an understanding of a few simple dietary rules. Although by following these rules it may not be possible to find the pot of gold at the end of the rainbow, the "balanced ration," on the other hand it may be entirely possible to do something very practical — to give balance to the daily dietary and to gain a certain freedom from family food customs, neighborhood food traditions, and, let us even hope, from personal food likes and dislikes.

To balance the dietary means: to supply in the meals of each day, in a form best suited to the individual, all the substances needed to build the tissues, bone, muscle, nerve, blood; to provide energy for the day's activities; to keep the body in good working order.

A dietary may contain ample bone-building material and may lack the substances needed to produce red blood corpuscles. The needs of muscles may be satisfied while bones and nerves remain hungry; or all tissues may be well supplied, but the dietary may be lacking in substances that regulate such processes as the flow of digestive juices, the activity of the intestine and its ability to empty itself, or the purification of the blood through neutralizing harmful compounds produced by the work of the body. The various body needs must therefore be taken into account in the planning of the dietary.

ADAPTABILITY OF FOODS TO BODY NEEDS

It is not possible to make an exact grouping of foods according to the definite part that each is capable of playing in the dietary, for most common foods are able to play several parts and therefore may satisfy a variety of needs. In a general way, however, it is possible to indicate which foods best serve a certain body need.

Foods especially adapted to furnish the foundation substances of all living, active tissues:

Milk	Legumes
Eggs	Nuts
Cheese	Cereals
Meat	

While all these foods are nourishing, they cannot replace one another in every respect. For example, either milk or eggs might be chosen for the purpose of muscle-building; but milk is much richer than eggs in

bone-building, and lime and eggs are richer than milk in red-blood-corpuscle-producing iron. Cereals, legumes, and nuts are all richer in energy than are milk, eggs, or meat, and meat has a stimulating property lacked by the others.

Foods especially adapted to supply the body with energy:

Cereals	Foods rich in starch and sugar
Legumes	Foods rich in fat

Foods especially adapted to supply lime to the diet:

Milk	Cabbage
Legumes	Celery
Whole cereals	

Milk is the best source of lime. No food can replace it satisfactorily in the diet of the growing child.

Foods especially adapted to supply iron to the diet:

Eggs	Vegetables
Legumes	Meats
Oatmeal	Fruits

Foods especially adapted to stimulate the activity of the intestine, and thus to keep the body clean:

Fruits	Cereals and cereal foods containing part or all of the outer layers of the grain
Vegetables	

Foods especially adapted to neutralize harmful substances produced in the tissues and blood:

Fruits	Vegetables

THE CHOICE OF FOODS

The main part of the meals of each day should consist of simply prepared, mild-flavored, non-stimulating, and easily digested foods.

Well-cooked cereals; thoroughly baked, sweet-flavored bread; potatoes; milk; eggs; fresh, succulent vegetables; and fruits — these should constitute the background of the dietary.

Meats and meat soups, candies, preserves, desserts, cakes and other sweets, rich sauces, pickles, and condiments should be used in moderation in order to give color and interest to the dietary, but they should not furnish the bulk of the food at any one meal.

Milk should be used liberally in order to replace a part of the meat in the average dietary, and because, of all foods, it is richest in lime.

Children, even after the first year, should use about a quart of milk daily; more than this is inadvisable. Adults need considerably less milk than do children, but they are better nourished if milk is present in the diet. If, as occasionally happens, milk reacts on the individual as a poison, a special study should be made in order to include in the dietary foods other than milk that are rich in lime. Many times, however, a dislike for milk may be confused with inability to use it. If it is merely distaste that prevents its use, milk may be included in the dietary by being cooked with other foods.

Eggs should be used as long as they can be afforded. One egg a day for each child in the family; and one or two for each adult, are sufficient. If the cost of eggs makes their use impossible, thought should be given to increasing the use of other foods that are rich in iron. Frequently it is objected that milk and eggs cause biliousness. Certainly in the majority of cases the condition is due not to the use of milk and eggs, but rather to the absence of fruits and vegetables from the dietary.

Fruits and vegetables should be used liberally in the dietary, for they are among nature's best body-cleansing and regulating agents. They furnish substances which stimulate the activity of the intestine, neutralize the harmful acids produced by the tissues, and keep both intestine and blood in good condition.

Fruits stimulate digestion and are appetizing additions to the day's food. There is much truth in the saying that "an apple a day will keep the doctor away." If "the onion a day which keeps every one away" is added, a good beginning is made toward a healthful dietary.

Complaint is often made that at certain seasons fruits and vegetables are too expensive to be used liberally. They are certainly not so expensive as the doctor's attendance, nor is their value comparable to a loss of efficiency resulting from a diet that lacks natural laxatives and blood purifiers. When apples are cheap they should be baked or made into apple sauce, and should be canned for use during a season of scarcity. Carrots, beets, turnips, cabbage, onions, and parsnips are cheap at a time when other vegetables are expensive, and if carefully prepared they are easily digested; and they not only give variety to the dietary, but also furnish the much-needed vegetable material.

A diet enriched by fruits and vegetables has a tendency to prevent or correct anæmia, to prevent constipation and its attendant ills, and to improve general health conditions in that it increases the amount of iron furnished to the blood and helps to prevent a putrefactive condition in the intestine.

Those cereals and cereal foods that contain the larger part of the grain should be given preference in the dietary.

While such a cereal food as white flour retains all the original energy-yielding ingredients and most of the muscle-building materials, it has lost in the milling process the substances occurring in the outer layers which stimulate the activity of the intestines and which help in such body functions as bone-building and the formation of red blood corpuscles.

White bread is entirely wholesome if thought is given to including, in forms other than bread, the substances lost by the flour during the milling process. This may be accomplished by using fruits and vegetables for their laxative properties, milk for its lime, and eggs for their iron.

Sweets in the dietary are unquestionably desirable, but they should be served in such a manner as not to reduce the appetite for other foods and not to satisfy the appetite with sweet foods only.

Fruits and vegetables, simple desserts of various kinds, jam with bread at the close of the meal, and candy occasionally in place of other desserts, are the best ways of using sugar. The craving for sugar between meals generally indicates a badly controlled appetite or a poorly fed individual; or it may be the outcome of some diseased condition of the body.

Candy or other sweet foods when eaten between meals result in poor appetite. Sugar is an abundant source of energy, is easily digested and absorbed, and has its place in the dietary; it is not a bone- and muscle-building food and, if used in large quantities, is very irritating to the mucous membrane. Therefore it should not be eaten to the exclusion of other foods. The candy-fed child, refusing as it does other foods at meal times, is very likely to have poor, decayed teeth, weak bones, flabby muscles, and a disordered stomach. The rule should be to use sugar with other foods and at the close of the meal.

Enough water should be consumed to maintain the body in clean, wholesome condition. It is just as necessary to bathe the body inside as it is out. Many cases of serious bodily disorder are directly traceable to neglect of the needs of the body for water. Constipation is frequently the result of insufficient water in the dietary.

The dietary should be planned so as to meet the needs of all members of the family. The main part of the meal may be made suitable for all, and to this the foods especially needed by each individual may be added. Little children should not eat all foods that are allowable to adults, nor should the grown members of the family be limited to the same simplicity of diet as the children, for children have undeveloped digestive organs that will be overtaxed by heavy foods. The strength of food in

the diet of the child should be increased only as the muscles of digestion strengthen and develop. Foods that are too strong overtax the immature digestive tract and foods that are too weak fail to develop it.

Persons working hard out of doors eat more food than those whose work is of a light indoor character; and not only are they able to digest easily foods that are rated as difficult to digest, but they may actually need food that will require at least moderate work on the part of the digestive tract. They may have a disagreeable feeling of hunger, even when sufficiently fed, if the food consumed does not "stay by them" for a certain period of time. Just the reverse is true of the indoor worker who uses his muscles but little. These facts are often overlooked, and frequently the whole dietary is shaped to the needs of one member of the family. *Hard muscular work increases the need for energy-producing foods, but does not materially affect the need for other types of food.*

EXAMPLES OF DESIRABLE FOODS

The following suggestions are offered as an aid in planning the family dietary. They are not to be regarded as complete, since many foods are omitted that might be included; but they are intended to illustrate types of food desirable for the several members of a family, and to suggest the strength of food for children at various ages. The recommendation of so simple a diet for children as the one indicated below often meets with the following objection: "My child eats everything that we eat and is entirely healthy and well; so why be so particular?" In answer attention must be called to the large number of grown persons who are inefficient because of an organism damaged during childhood by overtaxing the digestive powers.

Cereals

To be used each day by all members of the family

For children two to four years of age the best cereals are those that contain most of the cereal grain, such as the following:

Rolled oats	Farina	Corn meal
Rolled wheat	Hominy grits	Flaked barley
Wheaten grits		

After the child has learned to chew its food properly, cracked wheat, oatmeal, and the ready-to-eat cereals may be added to its diet.

Adult members of the family have free range of choice.

Fruits

One of the following should be used each day

For children two to four years of age

Orange juice	Apple sauce
Baked apple	Prune pulp

For children four to six or eight years of age add to the dietary

Fresh, ripe apples	Other mild fruits cooked or mashed to a pulp
Baked bananas	

For children eight to twelve years of age

Any ripe, mild fruit, cooked or raw

Free range of choice for healthy adults

Vegetables

To be used each day

For children two to six years of age

Potatoes boiled and thoroughly mashed or baked

For children six to twelve years of age add to the dietary

Potatoes, scalloped or creamed

One of the following should be used daily

For children two to four years of age

Spinach (mashed)	Stewed celery
Boiled onions (mashed)	Carrots (mashed)
Strained peas	Cauliflower tips (mashed)

For children four to eight years of age add to the dietary

Strained dried beans and peas
Fresh lettuce
Other vegetables carefully cooked

Free range of choice for older children and adults

Desserts

One of the following may be used each day

For children two to four years of age such simple desserts as

Baked apple	Apple sauce	Rice pudding
Prune pulp	Junket	Custard

For children four to eight years of age add to the dietary

Baked bananas	Ice cream in small quantities
Other cooked mild fruits	Plain cookies
Blancmange	Plain cakes
Fruit jellies served with bread	

For children over six or eight years of age

Chocolate or cocoa in moderate amounts, as a flavoring for puddings
Jams or fruit butters, with bread and butter

The common inclusion of rich desserts in the child's dietary is a frequent cause of adult inefficiency.

For the adult members of the family the type of dessert should conform to the vigor and activity of the individual. Heavy puddings, rich pies with a large proportion of crust, doughnuts, and other heavy desserts should not be used too freely by the person living indoors and taking little exercise. Although such desserts may be most satisfactory, and indeed desirable, for the man or woman who uses the muscles out of doors, they are likely to prove taxing to the indoor worker.

Milk

Milk should be used each day by all members of the family

For children two to four years of age

Milk should play a more important part in the dietary than any other food, should be included at each of the three regular meals, and should be given with bread between breakfast and the noon meal.

For children over four years of age

Milk should still be given in liberal amounts. If the child does not care to drink all the milk needed, milk may be included in desserts or may be given in the form of cream soups and similar dishes.

For adults, milk may be included in the form of desserts, soups, scalloped dishes; either sweet milk or buttermilk may be used as a beverage.

Eggs

If possible, eggs should be used daily for each member of the family. If too expensive to use daily, use at least three times a week for the children of the family.

For children two to eight years of age
- Very soft boiled or coddled egg
- Soft poached egg
- Very soft scrambled egg, made with little or no cream or butter
- Hard boiled eggs are not easy to digest and should not be given to young children
- Fried eggs may be perfectly wholesome for the vigorous outdoor worker, but may prove exceedingly taxing to the inactive person and should not be given to the child.

Free range of choice for adults

Meats

Meats may be used daily by healthy adults, but preferably such use should be limited to once a day.

The use of meat in the diet of children under the sixth or seventh year is questionable. Meat is a stimulating food not needed by children, and, of all foods, it is the one most prone to encourage putrefactive conditions of the intestines. The child's intestine is far less resistant to such conditions than is that of the vigorous adult.

For children seven to twelve years of age
- Haddock or other fish, preferably whitefish
- Rare roast beef, steak, or mutton chops
- Broiled hamburg steak
- Roast chicken, preferably the white meat

Free range of choice for the healthy adult

Breadstuffs

For children two to eight years of age
- Thin slices of bread at least a day old
- Zwieback or well-dried toast

For the vigorous adult, hot rolls, pancakes, waffles, and freshly baked bread may be allowable; they should not be given to young children, who, through their use, may acquire chronic indigestion.

Beverages

Tea and coffee should be used sparingly by adults and never by children.

Strongly acid drinks are not advisable for either children or adults. If lemonade or grape juice are used in quantity, they should be used in diluted form.

Very weak cocoa may be given to children after the fifth year.

Summary

Milk and eggs should be provided in any well-balanced dietary, and should replace at least a part of the meat.

Fruits and vegetables should be used liberally.

Sugar should be eaten with the dessert after the meal, and not between meals or as the main part of the meal.

Cereals and cereal foods that include most of the outer layer of the grain should largely replace those that have had the outer layer removed.

Age, vigor, and activity of the person should determine the strength of food to be eaten.

SUGGESTIVE MENUS

The following menus may be suggestive in planning the family dietary. They are intended to show how the main part of each meal may be made suitable to a family that consists of children of varying ages and of vigorous and hearty adults as well. No attempt has been made to discuss the food needed by the child under two years of age, since that is a problem by itself.

Menu I

Breakfast

Wheaten grits with cream or whole milk	For all members of the family
Oranges	For all members of the family except very little children, to whom orange juice may be given between meals.
Bread and butter	For all members of the family
Sausages	For adults
Pancakes	For adults
Coffee	For adults

In the above breakfast, cereal, fruit, and milk, if used in sufficient quantities, would be ample to supply the right nutrients for the adult as well as for the child. Pancakes and sausage are added in order to increase variety for adults who are accustomed, perhaps, to more liberal choice than is afforded by such simple foods as are here assigned to the children. The same generalization may be applied to all the menus that follow. The food planned for the child might theoretically satisfy the adult.

Dinner

Roast mutton	For all members of the family except children under seven years of age
Baked potato	For all members of the family
Spinach	For all members of the family
Bread and butter	For all members of the family
Milk to drink	Especially for children
Apple pie	For adults
Apple sauce	For children

An egg for children under seven years of age may be included in the above meal plan.

Supper

Milk toast	For all members of the family
Scrambled eggs	For adults
Bread and butter	For all members of the family
Peach sauce, Cookies	For all members of the family except very small children

Menu II

Breakfast

Rolled oats with cream or whole milk	For all members of the family
Stewed prunes	For all members of the family
Bread and butter	For all members of the family
Milk to drink	For all members of the family
Eggs	
Poached	For children
Fried	For adults
Coffee	For adults

Dinner

Pot roast	For adults and older children
Boiled potatoes	For all members of the family
Creamed onions	For all members of the family
Bread and butter	For all members of the family
Milk to drink	Especially for children
Custard pie	For adults
Baked custard	For children

Supper

Scalloped rice with cheese	For adults and older children
Plain boiled rice with cream or whole milk	For younger children
Bread and butter	For all members of the family
Milk to drink	Especially for children
Fruit sauce or baked apples Molasses cookies	For all members of the family

Menu III

Breakfast

Corn-meal mush with cream or whole milk	For all members of the family
Stewed fruit	For all members of the family except very little children; to be given to children between meals.
Bread and butter	For all members of the family
Milk to drink	Especially for children
Bacon	Especially for adults
Waffles	For adults
Coffee	For adults

Dinner

Baked hamburg steak	For all members of the family except children under seven years of age
Creamed potatoes (Mashed for small children)	For all members of the family
Buttered carrots	For all members of the family
Bread and butter	For all members of the family
Milk to drink	Especially for children
Steamed suet pudding	For adults
Baked apples	For children

Supper

Cream of bean soup	For all members of the family
Bread and butter	For all members of the family
Prune sauce	For all members of the family
Sponge cake	For all members of the family

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 41 | ITHACA, NEW YORK JUNE 1, 1913 | FOOD SERIES No. 8

RULES FOR PLANNING THE FAMILY DIETARY

DISCUSSION PAPER

The object of the discussion paper is twofold: first, it gives an opportunity to the reader to classify her knowledge on the subject treated; second, it enables the reader to contribute interest and ideas profitable to the success of the Reading-Course. Many ideas helpful to other readers are thus put into the "exchange" system; one object in the course is to "pass on" needed information. No contributor's name will be used without her permission. Even though a member thinks that she has nothing valuable to contribute to the course, she will nevertheless afford much satisfaction to the Supervisor of the Reading-Course if she will answer questions and thus show her interest.

1. What is your most troublesome problem in planning the family dietary?

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2. Is constipation a common cause of complaint in your home? If so, have you attempted to rectify it by change of food?

3. Basing your answer on suggestions in this bulletin, do you think the average dietary in the farm home is fairly well balanced? If not, in what respect is it deficient?

Name..............................

Address............................

Date.......................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 43 | ITHACA, NEW YORK JULY 1, 1913 | FOOD SERIES No. 9

THE BOX LUNCHEON

CLARA W. BROWNING

The box luncheon—what a train of thought that word suggests! You may think at once of a picnic; you may recall a cold lunch that was eaten in solitude; you may lament the bother of packing lunches; or you may

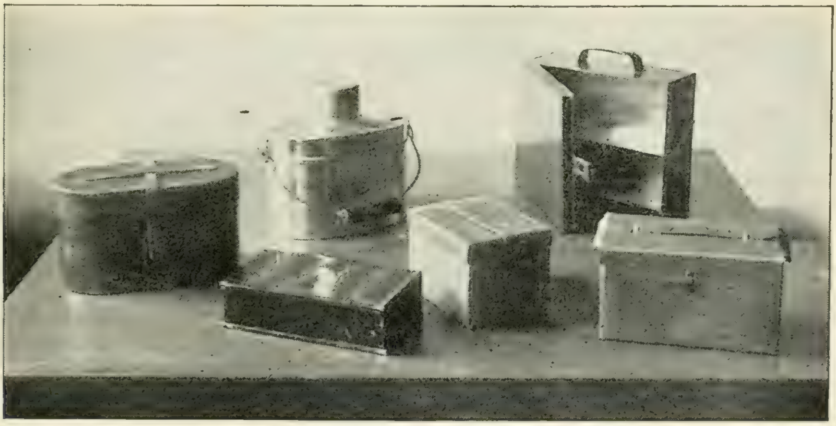

FIG. 75.—*Desirable types of luncheon boxes*

picture a neat box filled mysteriously with dainty surprise packages, expressive of some person's thoughtfulness. Whatever the memories that come to each, certainly all persons will agree that luncheon boxes should not be associated with picnics only. A serious problem presents itself when we consider the great band of workers and of school children who daily depend on the box luncheon for one third of their food supply. So considered, the box luncheon is not a means of furnishing refreshment between meals, but is for the purpose of supplying one of the regular daily meals. From this viewpoint the problem of providing the box luncheon is as important as that of providing any other meal. In her home no woman would neglect to prepare a suitable breakfast, dinner, or supper.

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If one member of the family be obliged to carry his noon meal with him, what care should be taken to make it a fit substitute for the nourishing home meal that he must do without! Instead of requiring less thought, the substitute requires more than is given to other meals.

Usually the luncheon must be cold, and hence somewhat unappetizing. Very often it must be eaten in solitude or amidst dreary surroundings, and therefore it may not be heartily relished. For these reasons the food should be especially tempting and nourishing. The luncheon of the school boy and girl should be planned with particular care in order to satisfy the demand for good taste and at the same time to insure the right kind of nourishment.

The factors to be considered in planning the box luncheon fall naturally under three heads—selection of food, preparation of food, and packing the luncheon.

SELECTION OF FOOD

The most important consideration in planning for any meal is the selection of food. Suggestions with regard to this problem have been given in Farm Home Reading-Course Lesson No. 41, in which emphasis is laid on the value and the use of various types of food: for example, the importance of fruit in the diet; the place of meat substitutes; the advantage of products made from the entire grain, as whole wheat bread; the judicious use of sweets; the changes demanded by the age and the occupation of the person; the facts that food for the growing boy or girl should differ from that of the working man, and that food for all members of the family should differ in winter and in summer. The same considerations have to be observed when the box luncheon is planned.

In addition to the dietetic problem common to all meals, the box luncheon introduces in the choice of foods the following peculiar difficulties:

Many foods are inconvenient to pack or do not taste good when cold; hence the choice is necessarily limited.

The box should contain no more food than is needed, and yet must hold sufficient to satisfy the appetite; therefore the choice must be very exact.

The meal is to be eaten away from the pleasant family circle; therefore the choice needs specially to include such foods as stimulate the appetite by giving daintiness and variety.

The above difficulties give rise to the question, "How may I, from the few foods available for lunches and in the limited space afforded by the luncheon box, combine nourishment and variety?" The following outline may serve to indicate both the essential features of the luncheon and the possibilities of variety:

Foodstuffs that the luncheon should always contain

A substantial background of plain, nutritious, and mild-flavored foods, such as

Sandwiches	Bread and egg
Bread and butter	Bread and meat

A succulent food, such as

Apples	Lettuce
Apple sauce	Tomatoes
Peaches	Fruit jellies
Oranges	

A dessert or dainty, such as

A piece of pie	Nuts and raisins
A piece of cake	Cookies
A few pieces of candy	A pudding or custard

Possibilities of variety in selecting foods for the box luncheon

The sandwich
- Kinds of bread for sandwiches
  - White bread, brown bread, raisin bread, graham bread
- Materials for filling sandwiches
  - Meats: sliced thin, chopped or ground, and softened with cream or salad dressing
  - Fish: sardines, salmon, oysters, shrimp. Used as purchased or made into paste with dressing
  - Eggs: fried, chopped and mixed with salad dressing, sliced and seasoned
  - Cheese: both soft and firm cheeses are good, either sliced or made into paste. Mixtures of soft cheese, such as cheese and pimento, cheese and nut, cheese and olive
  - Vegetables: lettuce, water cress, cucumber, beans, pepper relish, tomato
  - Fruit: jellies, marmalades, preserves, fig filling, raisin filling, preserved ginger
  - Miscellaneous fillings: combinations of above, peanut butter, baked beans

Meats
- All meats may be used

Potatoes
 Since as a rule potatoes do not taste good when cold, only two ways of using them are recommended
  Potato chips, potato salad

Fruit
 Oranges, apples, pears, peaches, plums, berries, grapefruit, figs, dates, bananas

Eggs
 Boiled, deviled

Vegetables
 Tomatoes, baked beans, celery, radishes, onions

Desserts
 Cookies, candy, cakes, pies, nuts, doughnuts

Relishes
 Horse-radish, mustard pickles, pickled beets, chowder

If suitable containers are used, the list may be extended to include:
 Puddings, preserves, sauces and canned fruits, milk, fruit juices

If there are facilities for heating foods, the box luncheon may be extended to include such foods as
 Cream soups, meat soups, meat stews, cocoa

From this list of foods, together with the many combinations that it suggests, selections may be made to satisfy all needs. In making a choice, however, careful thought should be given to the age, digestive powers, growth, needs, and activities of the persons for whom the food is selected. While the growing child with immature digestive apparatus has much the same fundamental food needs as has the vigorous outdoor worker, he will not be able to assimilate the same strength or the same amount of food as will such a worker. More attention should be paid to attractiveness and flavor in the luncheon of the child than in the luncheon of the older, and possibly more vigorous, person.

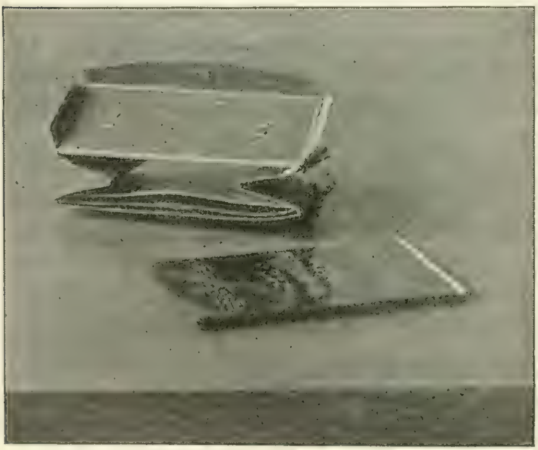

FIG. 76.—*Two types of folding boxes*

Differences in the food needs of various individuals are too often overlooked, especially in the case of children's luncheons. As a result, luncheons frequently consist of foods that are difficult for children to digest, such as pies, doughnuts, meat, and pickles; at the same time such luncheons lack simple, nutritious, and easily digestible foods, such as eggs, bread and butter, fruit, simple cakes, cookies, and milk.

Typical luncheons for school children or for persons not exercising actively

I

Bacon	Apples, raw or cooked
India-relish sandwiches	Molasses cookies

A few nuts or a piece of candy

II

Egg sandwiches	Oranges
Jam sandwiches	Plain cake

Two or three figs

III

Stuffed eggs	Plum sauce
Bread and butter	Sugar cookies

Two or three dates

IV

Meat-paste sandwiches	Apples, raw or cooked
Potato and onion salad	Sponge cake

Milk to drink

Typical luncheons for those whose work requires active physical exertion

I

Baked beans	Apples
Brown-bread sandwiches	Doughnuts

Pickles

II

Cold meat and pickles	Peach sauce
Bread and butter	Mince pie

III

Fried-egg sandwiches	Oranges or other fruit
Jam sandwiches	Pudding, tarts, or pie

A few nuts or a piece of cheese

IV

Cheese	Cake or cookies
Bread and butter	A few dates or a few pieces of candy or a few nuts and raisins
Sliced onions	
Apples or other fruit	

V

(When hot foods are possible)

Cream soup	Cookies
Bread-and-butter sandwiches	Fruit
	Nuts and raisins

VI

Cocoa	Canned peaches
Egg sandwiches	Plain cake

A few dates

PREPARATION OF FOOD

When the menu has been determined, the next consideration is the preparation of food. Poorly cooked food has no place in the model lunch-

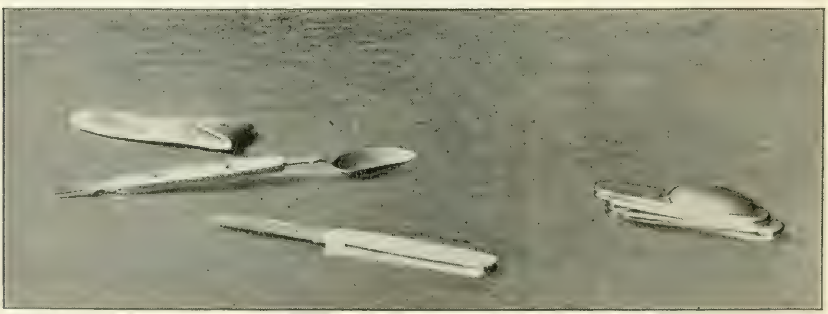

FIG. 77.—*A convenient combination knife, fork, and spoon which folds compactly into small space*

eon box. The box should always contain well-cooked food that is either purposely prepared or foraged from the cupboard. In fact, the box luncheon affords an excellent opportunity for the use of good left-overs. With a little skill, many scraps of food that appear unattractive may be

made very appetizing. Dried ends of meat, ground and mixed with salad dressing or cream, constitute a delicious sandwich filling. A slightly dry piece of cake split and spread with jelly will satisfy the most critical appetite.

A few suggestions regarding the preparation of some typical foods for luncheons may serve to indicate the care necessary in preparation of all types:

Sandwich-making

The bread should be cut evenly

The thickness of the slice should depend on the vigor and the appetite of the consumer

Thinly sliced bread appeals to the person who is not a vigorous worker and who therefore has not the need for large quantities of food

Whether thick or thin slices of bread are to be used is not so important to the palatability of the sandwich as are the manner and the quantities in which the butter and the filling are used

Butter should be softened by creaming it with a spoon or a knife, and should be spread evenly over the entire surface of the slice of bread. This method is easier and quicker than spreading the bread with lumps of unsoftened butter, which disfigure the sandwich

The thickness of the layers of butter and filling should depend on the thickness of the slices of bread

Both slices of bread should be buttered, since butter keeps the bread moist and prevents the filling from soaking into the bread and thus making the sandwich wet and unappetizing

A ragged, crumbly, soaked sandwich is not a tempting luncheon to serve even to the most undiscriminating person

A sandwich should be wrapped in waxed paper in order to prevent it from drying out and to prevent the absorption of flavors from other parts of the luncheon

Moist foods

Foods that are likely to dry out, to become disfigured by pressure, to absorb other flavors, or to distribute their own flavor — such as cake, cookies, pieces of meat, slices of onion, certain fruits, cheese, stuffed eggs, or eggs without their shell — should be separated from other foods by wrapping them in wax paper or, if that is not available, in plain, clean paper.

Liquid foods

Preserves, sauces, and the like should be put in small, clean, sealed containers.

Suggestive recipes

Although many persons know how to prepare package meals, a large number of others do not. If each person would by careful thought and practice improve the luncheons over which she has supervision, the words "box luncheon" might come to suggest to every one only pleasant recollections.

Sandwich filling

3 eggs, hard boiled and chopped fine or ground
An equal amount of chopped or ground boiled ham
Salad dressing
Mix and spread

Cucumber and onion

Chop, or grind through meat-chopper, cucumbers and onions in proportion to suit taste
Salad dressing

Raisin filling

1 cup raisins ground or chopped
½ cup water
½ cup sugar
1 tablespoonful flour stirred into vinegar
Juice and grated rind of 1 lemon
Cook in double boiler until thick

Egg filling

Scrambled egg with crisp bacon

Sliced tomato and pimento sandwiches

Thin sliced tomatoes
Pimento cheese
Salad dressing
Place between thin slices of bread

Chicken sandwich filling

Chop cold boiled chicken, and moisten with salad dressing; or season with salt and pepper and moisten with rich chicken stock.

Chopped cold boiled chicken and ham, mixed with creamed butter, makes a delicious filling.

Fruit sandwich filling

Remove stems and finely chop figs; add a small quantity of water, cook in double boiler until a paste is formed, then add a few drops of lemon juice. Chopped peanuts may be added.

Ginger sandwiches

Cut preserved Canton ginger in very thin slices and use between slices of buttered bread.

Oyster sandwiches

Arrange fried oysters on crisp lettuce leaves and prepare as other sandwiches.

Club sandwiches

Arrange on slices of bread (toasted or untoasted) thin slices of cooked bacon; cover with slices of roast chicken and cover chicken with salad dressing. Place a slice of bread on top.

Tomato sandwich filling

1 quart can of tomatoes boiled down to 1 cup

½ pound American cheese and ½ pound dried beef, ground together

Mix

Add salt and pepper, boil to desired thickness for spreading

When cool, beat in one egg

Stuffed eggs

Cut hard-boiled eggs in halves lengthwise or crosswise; remove yolks, and season with salt, pepper, vinegar, and mustard, to suit taste. Add butter to make mixture of smooth consistency. Refill whites. Wrap halves or whole eggs in wax paper.

PACKING THE LUNCHEON

After food selection and food preparation, the third consideration that demands attention is careful packing. Surely the means and the method for the proper packing of a luncheon should receive thought. The box luncheon must be an example of convenience, neatness, and attractiveness. Without these qualifications the most nutritious food may lose much, if not all, of its value, for unattractive food may fail to make an appeal to

appetite and digestion. Unattractive food is not eaten with relish, and may not be eaten at all.

Materials essential to good packing

Wax paper
Paper napkins
Paper wrapper, bag, box, basket, or dinner pail

Wax paper, such as is used for covering butter, can usually be obtained from the grocery store.

Plain paper napkins, the most desirable kind, can be bought for ten cents a hundred or eighty cents a thousand.

FIG. 78.—*A few box-luncheon conveniences*

For the occasional lunch, bags or boxes that one has on hand are convenient; but the supply soon fails if a daily lunch is being prepared. In the latter case a more permanent container than the paper bag or box is desirable.

Fiber boxes seem inexpensive, but, since they easily dampen or become soiled and cannot be washed, they have to be replaced by others. When not in use fiber boxes should be well aired. Certain kinds are provided with small ventilators placed in a dust-proof location under the ends of the handle.

Tin boxes can be cleaned easily and they prevent the drying-out of their contents.

Most dinner pails have compartments for various kinds of food. The pail shown in Fig. 75 has compartments for sandwiches, meats, pie, and coffee. The coffee compartment, unlike the kind usually seen, is easily cleaned, the entire bottom being separate so that the cleaning need not be done through the small hole under the cup.

Lunch baskets are light and well aired. Particular precautions must be taken, however, to prevent the food that they contain from drying

out. Only wrapped food should be laid against the basket. Even if this precaution is followed the basket will need to be scrubbed frequently with soapy water and thoroughly dried.

Box-luncheon conveniences that are not necessarily essential

Folding boxes (Fig. 76)

Small aluminum salt-shakers

Knife, fork, and spoon set, which folds into small space (Fig. 77)

A neat set of cups, which fit into the space ordinarily occupied by one cup (Fig. 78)

Paper cups, which are light and which, after being used, may be thrown away (Fig. 78)

Seal-tight jars for semi-liquid foods (Fig. 78)

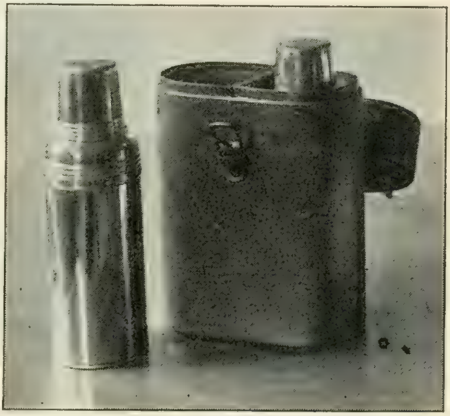

FIG. 79.—*Case with two thermos bottles. A convenient addition to the luncheon outfit*

The thermos bottle, in which liquids remain hot or cold

The thermos food jar, which is a wide-mouthed thermos bottle

A combination of two thermos bottles, which makes possible the inclusion of hot and cold liquids for one meal (Fig. 79)

The luncheon basket or suit case, completely equipped with plates, knives, forks, spoons, and the like

Method of packing lunches

As has been said, foods should be wrapped in wax paper before being placed in the box.

The neatly wrapped articles should be placed, so far as is possible, in the order in which the food will be eaten, so that those found first may be eaten first without disturbing the remainder.

Articles should be placed compactly in order to reduce the size of the package and to prevent the food from shaking about. Empty space may

be filled neatly with paper, or, if made from pasteboard, the box may be cut down to the required size. When space seems lacking the difficulty may be overcome by more careful packing, by resorting to such expedients as cutting fruit or cookies, or by packing sandwiches the other way of the box.

The package requiring wrapping should be neatly wrapped. That there is a difference in methods of packing and wrapping is illustrated by Fig. 80.

FIG. 80.—*Luncheons wrapped in paper, packed in boxes covered with paper, or carried in a paper bag may present either a careless or a neat appearance*

If called on to act as judges in a luncheon-box contest we might draw up for ourselves a score card like the following:

	Rating
1. Neatness of box or wrapper	5
2. Appearance of the inside of the box	25
Neatness	
Daintiness	
3. Quality and preparation of food	35
Excellence of preparation	
4. Selection of food	35
Fitness for purpose	
	100

SUPPLEMENT TO

The Cornell Reading-Courses

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L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

VOL. II. No. 43 | ITHACA, NEW YORK JULY 1, 1913 | FOOD SERIES No. 9

THE BOX LUNCHEON

DISCUSSION PAPER

By means of the discussion papers we have an opportunity to become acquainted. We shall take it as an indication on your part that you are interested if you answer the questions and return them to us. The staff of the Department of Home Economics is ready to assist in your study of scientific home-making. We want your assistance as well. Ask questions, offer suggestions, let us have the benefit of your experience. You thus become a vital part of the Department of Home Economics in its efforts for scientific housekeeping.

Will you please send your opinions on the following points to the Supervisor of the Cornell Reading-Course for the Farm Home?

1. From your experience can you give helpful suggestions regarding conveniences and recipes for box luncheons?

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2. What can you do to improve the luncheons of the children in your community?

3. Discuss the possibilities of providing a warm dish at noon for the children in your schools.

4. In your school could the school luncheon be used as a means of teaching domestic science?

Name ....

Address ....

Date..........................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

ENTERED AS SECOND-CLASS MATTER AT THE POST OFFICE AT ITHACA, NEW YORK

VOL. II. No. 45 | ITHACA, NEW YORK AUGUST 1, 1913 | HOUSEHOLD TEXTILE SERIES No. 1

HINTS ON CHOOSING TEXTILES

BERTHA E. TITSWORTH

In former times family textiles were manufactured mainly in the home and the best products from the farms went into the making of them. As the population increased and economic conditions changed, these industries were taken from scattered homes and centralized in factories where the introduction of complicate machinery and systematized methods greatly increased the output and decreased the cost of manufacture. Woman has calmly accepted this release from responsibility, and too often has allowed the change to free her from all care as to the value and the quality of the product that she must accept from the manufacturer and use in clothing the family and furnishing the home. One result of this indifference is that license has been taken in placing on the market materials of inferior quality, misnamed, and deceptive in appearance. In order to guard against this deception a general knowledge of the manufacture and the adulteration of textile fibers is necessary; and such knowledge will enable the housewife to obtain better value and better satisfaction for the time, money, and energy expended.

There are four common textiles: cotton and linen, which are vegetable fibers; wool and silk, which are animal fibers.

COTTON

The commonest and the least expensive fabric is made from the short, twisted, seed-hair fiber of the cotton plant. The seed hairs are gathered, carded, spun, and woven into cloths varying in texture according to the weight of thread and the kind of weave used. The supply of cotton usually equals the demand, so that the finished product may be put on the market at very reasonable prices.

A modern product is mercerized cotton, made by treating the fiber or the cloth with strong alkali and then rinsing it under tension. The resulting fabric is lustrous and durable, and retains its luster after repeated washings.

Adulterations

In spite of abundance of raw material and ease of manufacture, cotton fabric is often adulterated. Inferior qualities are made to appear of good grade by being sized with starch, gums, and china clay.

Imitations of linens and of mercerized cottons are often placed on the market and sold for the same prices as are charged for genuine material. In order to obtain the mercerized appearance, ordinary cotton is passed between two heavy rollers that give a luster similar to the luster of the more durable fabric under the name of which it will be sold. Such a process is called calendering.

Chemicals used in bleaching and in stamping designs on cotton fabrics often weaken the fiber to such an extent that cloth may become almost worthless if it is allowed to lie on the shelf for some time before being used. This is more likely to be true of cheap grades of cotton, since less care is used in their manufacture than in the manufacture of fine cloths

Tests for adulteration

When cloth that has been adulterated is held to the light the meshes are seen to be filled with sizing.

If sizing has been used to a great extent, a piece of cloth rubbed briskly will show white powder.

If cloth is thoroughly boiled for a few minutes the filling will dissolve out.

Boiling and rubbing will remove the calendered polish from the so-called linens and mercerized cottons.

If a sample that is thought to have been weakened by the action of bleaching chemicals is torn, its weakness will be easily detected.

Suggestions

Cotton fiber is covered by cotton wax, which serves as a protective coat and renders cotton material very slow in absorbing water. For this reason cotton dish-towels are unsatisfactory. If a cloth to absorb moisture is desired, it must be made of a fiber that is not water-repellent. In absorbent cotton the wax has been removed.

Cotton is light in weight and inexpensive, and affords a most desirable fabric for general wear. It is especially desirable for undergarments and house dresses, since it is not impaired by frequent laundering.

Starch is absorbed by the cotton fibers as readily in the process of laundering as at the time of manufacture. It is therefore possible to keep the garments as fresh as when new.

Cotton fabrics shrink for the first few times that they are laundered. The percentage of shrinkage varies with the type of fiber and the method of manufacture of the material. A loosely woven material will often shrink more than will a closely woven piece.

The ability to take and hold dye well renders cotton fabrics durable in color.

Since dainty colors will often fade in washing, it is desirable to set the color before washing colored cloth. Various formulas are given for setting color in cotton fabric. It is often best to test the material in two or three solutions in order to find which is best suited to the color. Any one of the following solutions is recommended:

1 cup salt in 1 gallon water
½ cup vinegar in 1 gallon water
1 tablespoon sugar of lead in 1 gallon water

Best kinds of common cotton fabrics and their uses

Batiste.—A sheer lustrous cloth in white and dainty colors. Used for waists and thin dresses because of its daintiness.

Calico.—Cotton cloth with a design printed on one side. Used for inexpensive dresses, aprons, and wrappers because of its low cost, its durability, and the ease with which it is laundered.

Cambric.—Plain weave with a smooth finish on one side. Used for linings and for underwear when a moderate weight is desired. Berkeley cambric is a fine quality that is used for underwear.

Canton flannel.—Heavy cloth with twilled surface on one side and soft nap on the other. Used for children's underwear because of warmth and durability, and for linings in order to add warmth to other garments.

Flannelette.—Soft cloth with nap on both sides of weave and with figures printed on plain backgrounds. Used because of warmth, low cost, and ease of laundering, for nightgowns, underwear, and children's wrappers.

Gingham.—Plain weave with warp and woof of variously colored threads that form plaids and stripes. Used for dresses, aprons, and shirts.

Galatea.—A heavy, firm weave with design printed on one side. Used for children's clothes, outing suits, and the like, when a cloth of strength and durability is desired.

Long cloth.—Soft, firm fabric with a close weave. Used for children's dresses, aprons, and underwear. Made in many qualities. This cloth is used when softness and lightness of weight are desirable.

Lawn.—Light-weight, sheer cloth that is usually well sized. Used for dresses, aprons, and curtains because of its sheer quality.

Madras.—Firm, close weave with stripes and figures in color on a white background. Used for dresses, shirts, and shirtwaists because of its novelty in design, weave, and color combinations.

Muslin.—A plain weave made in several qualities, bleached and unbleached. Used for sheets, dresses, and underwear when strength and durability are primary objects.

Percale.—A firm, closely woven cloth. Used for dresses, shirts, and aprons because of durability, ease of laundering, and relatively low cost.

LINEN

In olden times linen was used for many of the needs of the family, but to-day cotton has largely supplanted it for common uses.

Linen is made from the long, lustrous fiber obtained from the stock of the flax plant grown in European countries and to some extent in America. Linen fibers are rich-looking and are woven into a fabric that finds many uses, according to its weight and weave. The luster of the fiber enables it to shed soil easily, but its tendency to become easily wrinkled is often an objection to its use in the wardrobe.

Since linen is difficult to dye and its colors often fade, it is economical to buy colors that are likely to be durable.

Flax fiber is expensive to grow and to manufacture and the finished product must demand a good price. If high prices are paid for linen, the purchasers should be able to know that pure linen will be delivered.

Adulterations

Damasks and dress linens often contain large percentages of mercerized or calendered (an imitation of mercerized) cotton. It is difficult to distinguish between the two when they are starched and well finished, so that the buyer is often deceived.

Tests for adulteration

Linen threads break with an uneven, pointed end, whereas cotton threads break with an even-tufted end.

If cotton and linen fabrics are briskly rubbed between the fingers, the surface of the linen will be smooth, while the surface of the cotton will be rough owing to the many ends of short fibers.

A drop of olive oil, or any similar oil, may be placed on a sample of cloth to be tested and the cloth laid between two blotters. If the cloth is linen the spot will be translucent; if it is cotton the spot will appear opaque.

Suggestions

Linen fiber absorbs moisture readily; it is therefore very suitable for towelings and for other materials that are used to remove moisture from surfaces. This power of absorption is the cause of the complete absorption of light oils by linen and the resulting transparency.

Its durability makes this fiber desirable in dress-goods fabrics as well as in sail cloths, canvas, and sacking.

Linen is more easily disintegrated than cotton, and therefore does not withstand the action of boiling alkali solutions, bleaching powder, and oxidizing agents. This characteristic, together with its slow reaction to dyestuff, makes it difficult to obtain a fast color that will take hold of the fiber. Natural color and white are therefore more likely to give complete satisfaction than any applied color in linen fabrics.

The luster of the linen fiber makes the fabric desirable for table linen, dresses, and dainty pieces of fancy work. The rich texture and satisfying designs in the weave are pleasing. Its tendency to shed dirt makes it a very useful fabric.

Rich, heavy materials of linen are soft, drape gracefully, and are useful for hangings.

Linen should be used for

- Dish towels, because it absorbs moisture readily.
- Tablecloths, because of its beautiful texture and the fact that it sheds soil readily.
- Household fancy work, because of its whiteness and the permanency of its bleach.
- Summer dresses, because it is beautiful and cool, and because of the absorption and the consequent evaporation of moisture.

Kinds of linen fabrics and their uses

Butcher's linen.—A heavy, coarse weave. Used for butcher's aprons, and for dress skirts because it is durable, attractive, and inexpensive.

Cambric.—A fine fabric. Used for dresses and handkerchiefs because of its sheer texture.

Crash.—A coarse weave. Used for toweling, dresses, and upholstery. It is rough and lends itself to various artistic uses because of its effectiveness.

Damask.—A fine satin weave with figured designs. Used for towels, tablecloths, and napkins because of its beauty and its power to shed dirt.

Huckaback.—An uneven weave with much of the woof showing. Used for toweling because of its rough surface, which easily absorbs moisture and causes the skin to glow.

Handkerchief linen.—A firm weave. Used for babies' dresses and for handkerchiefs. It is very fine and dainty.

Linen lawn.—A sheer weave. Used as cambric and handkerchief linen.

Sheeting.—A wide, firm weave. Used for bed sheets, dresses, and suits because of its durability and beauty.

WOOL

Wool comes from the backs of sheep, and it plays an important part in our textile industry. The fiber is curly, has a scaly structure, and is slightly elastic although not very strong. The scaly surface gives wool the property of felting, or the matting together of wool fibers by the interlocking of the projecting edges of the scales.

Adulterations

Since the demand for raw wool greatly exceeds the supply, various means are used to adulterate the fabrics. Many of the wool garments on the market to-day are made of shoddy, which consists of odds and ends obtained from the factory, the tailor, and the rag-picker—almost any wool fiber, long enough to have two ends, is used in making woolens. The use of shoddy makes it possible for the supply of woolen goods to be as large as it is to-day. If new wool alone were used, the supply of materials would be so far below the demand that many persons would have to go without warm woolen clothing.

The objection to the use of shoddy is that often materials sold for high prices and supposed to be of new wool are made for the most part from old, short wool, and the customer is not receiving what he asks and pays for. Besides, the materials made from a large percentage of shoddy are not so durable as those made from new wool, although they are as warm as, if not warmer than, those from closely woven new wool.

Cotton, treated to appear like wool, is used in large quantities to adulterate wool.

Tests for adulteration

The ends of broken threads of wool fibers will appear kinky, wiry, and uneven when compared with the even, tufted ends of cotton fibers.

Wool fibers pull apart when broken, while cotton fibers snap.

If a match is touched to these fibers, a slow burning of wool and a crisp ball of ash result, with the characteristic odor of burned hair. This should be compared with the brisk crackling of cotton, from which practically no ash results.

Animal fibers dissolve readily in a weak, hot solution of caustic potash, or potash lye. If a sample boiled in this solution is completely dissolved, it is wool. If it is part cotton, the wool fibers will disappear and the cotton fibers will remain,

Woolens

Woolens are made of short, staple, wool fibers that have been carded and spun into yarn with the threads lying in all directions. The cloth is often heavily felted, or matted, so that it is easy to hide cotton threads in the weave underneath the felting.

Albatross.—A soft, loose weave. Used for dresses because of its warmth and lightness of weight as well as its moderate cost.

Blankets.—A combed wool with nap surface. A type of weave that enables the fabric to hold a large amount of air in the meshes and thus to retain warmth.

Broadcloth.—A closely woven fabric with smooth, glossy surface. The fibers are pricked to make a nap, which is pressed down, leaving a beautiful finish. Used for suits and dresses because of its beauty, durability, and warmth.

Cheviot.—A twilled weave with both rough and smooth finish; heavier than serge. Used for suitings because of its durability and warmth.

Covert.—A heavy, twilled cloth. Used for overcoats and suits. Easily pressed and more able to shed water than most woolen fabrics.

Eiderdown.—A soft, napped fabric with a very heavy pile. Used for wrappers because of its softness and warmth. Often contains cotton.

Flannel.—A plain weave. Used for children's clothes, petticoats, and dresses because it is soft, warm, inexpensive, and not irritating to the skin.

Homespun.—A rough, loose material. Used for men's suits and women's dresses because of warmth, beauty of texture, and durability.

Tweed.—A rough, unfinished, coarse cloth. Used for men's suits. Durable, warm, and of attractive texture.

Worsteds

Worsteds are made from long, staple fibers that have been carded and combed until they lie parallel, and then twisted hard. The weave generally shows in worsted, and it is therefore difficult to adulterate except with long cotton threads that are easily detected.

Serge.—A twilled weave of different varieties. Used for suits and dresses. Very durable, holds pressing well, and is attractive.

Suitings.—A firm, close weave. Used for suits because of its ability to stand constant wear, hold pressing, and look well.

Many of the new season fabrics are made from worsted yarn and are sold under various names according to the weave.

Suggestions

The scales on the wool fiber, together with the elastic nature of the fiber itself, cause the manufactured materials to be porous and capable of holding air in their meshes. Since air is a poor conductor of heat, this aids the retention of body warmth without hindering the evaporation of perspiration. For this reason, woolen clothes are desirable for winter wear in cold climates.

As compared with other textile fibers, wool is light in weight in proportion to its warmth.

Wool absorbs moisture very slowly. It retains drops of moisture on the outside fibers, and the lustrous surface of these fibers often causes the drops to slide off. Thus it actually sheds moisture.

The durability of materials made from wool is due to the elastic nature of the fiber.

Wools absorb dyestuffs readily and ordinarily retain them in their original color during the full life of the fiber.

The felting, or matting, quality of wool is much increased by treating the wool with acid or alkaline solutions or even with boiling water. Such treatment softens the fiber and opens up the scales to such an extent that, when the fabric is cooled or dried, the fibers interlock more firmly than under ordinary conditions. It is therefore best to wash woolens in lukewarm water and to use mild soap in the water. In washing woolens friction should never be permitted, since it roughens the scales, causes their interlocking, and hence results in a shrinkage of the material. Wool should always be washed by squeezing the cloth between the hands and by moving it back and forth in the water.

It is economical to buy good worsted fabrics for the following reasons:

- They are made from new, long, wool fibers and therefore make a strong fabric.
- They seldom contain shoddy.
- They hold in place well when pressed.
- They are firmly woven and are not easily frayed.
- They will endure constant wear for more than one season and, if cared for, will look well as long as they last.

Their colors are fast and are less likely to fade than are those of cheaper materials made from wool.

SILK

The fiber that is the finest and most lustrous of all is that spun by the silkworm as it makes its cocoon. One filament of silk may be as long as four thousand feet, and about five double filaments are required in order to make up the thickness of a strand of raw silk. These long, perfect filaments are taken from the cocoons when the silkworm has been killed by the heat. If the moth is allowed to hatch, the filament is broken in many places and a second-grade product, called spun silk, must be made from the less lustrous, broken fibers.

In the raw state, silk is sold by the pound. Three thousand silkworms are required to spin one pound of silk, and one to two pounds are required in order to make a dress. When these statistics are considered it will be seen why good silk must necessarily be expensive. There is demand for a product at a moderate price, however, in order to satisfy which the manufacturer resorts to methods of adulteration.

Adulterations

Silk fiber has the quality of absorbing metallic salts and dyes without appreciably changing the external quality of the material. This process of weighting silk is often carried to the extreme, and the fiber is then forced to absorb even more than its own weight of metallic salts. This seriously interferes with the durability of the silk, and as a result the silk splits or falls apart before it has stood even a reasonable test of wear. The durability of present-day silk falls far short of that of our grandmothers. When rightly treated, the silk fiber is very durable.

Cotton threads are interwoven with silk, especially in sateens, velvets, and brocades, in which they may be entirely hidden.

Mercerized cotton is often used in silk manufacture, and its glossy appearance may easily be mistaken for the fiber that it imitates.

Tests for adulteration

When burned, a sample of silk will give forth the odor of burning feathers that is distinctive of the animal fibers.

If silk is heavily weighted, the mineral ash will retain the full size and shape of the original sample but will fall apart at the touch.

Suggestions

Silk is light in weight, has a beautiful luster, and can be woven in many ways so as to give attractive results in beauty of texture and design. It

is for this reason that silk is desirable for the making of rich garments, hangings, and draperies.

The soft silks are less likely to be weighted than are the heavy, rustling silks, and are more durable.

GENERAL CONSIDERATIONS

The intelligent choice of textiles for the family does not in any way end the responsibility concerning them. That which is good enough to spend time, money, and energy in obtaining is good enough to be cared for.

All clothes should be carefully shaken and aired before being placed on hangers in the clothespress. If cleaning and mending are necessary, these should be done at once.

Coat-hangers should be wrapped with tissue paper in order to keep the ends from leaving their marks in sleeves. Special hangers, or loops, should be attached to skirts.

Clothes should not be pressed too often, as the fiber may be weakened by too much heat and pressure; and they should be pressed on the wrong side, except in steaming. In steaming a fabric, a dampened cloth should be placed on the part to be pressed, and should be ironed until it is nearly dry; then the fabric should be turned on the wrong side and pressed dry.

"Clothes make the man" to the extent that good materials, well made up and cared for, give the wearer self-respect and demand respect and consideration from others. It is well, therefore, that the woman who spends should know what is on the market and should be able to recognize good value for money expended. She should not allow herself to be led into buying sale specials and season novelties, which are often made for quick trade and are not durable. So much of the family welfare depends on this one condition of life that time spent in its consideration will not be lost.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

ENTERED AS SECOND CLASS MATTER AT THE POST OFFICE AT ITHACA, NEW YORK

VOL. II. No. 45 | ITHACA, NEW YORK AUGUST 1, 1913 | HOUSEHOLD TEXTILE SERIES No. 1

HINTS ON CHOOSING TEXTILES

DISCUSSION PAPER

Those who receive the Reading-Course for the Farm Home may contribute much toward arousing public sentiment for honest textiles. We have been successful in our demand for pure foods and the same interest is needed in order to regulate textile industries. To that end, will you study the conditions under which you are buying textiles for household use and for wearing apparel? We greatly desire to know of your experience and to have your suggestions.

Have you written to the Supervisor of the Reading-Course this year? She may need to hear from you in order to know wherein the Reading-Course is of value to you.

1. What has been your experience with adulterated wool goods?

2. Have you any good methods for setting colors, other than those given in this paper?

3. Have you had any interesting experiences with textiles?

Name..................................

Address..................................

Date..................................

The Cornell Reading-Courses

LESSON FOR THE FARM HOME

L. H. BAILEY, *Director*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, *Supervisor*

Entered as second-class matter at the post office at Ithaca, New York

VOL. II. No. 47 | ITHACA, NEW YORK SEPTEMBER 1, 1913 | RURAL LIFE SERIES No. 4

A CANNING BUSINESS FOR THE FARM HOME

CLARIBEL NYE AND BESSIE EARLL AUSTIN

What man, woman, or child does not have the ambition to earn money? Such an ambition is entirely natural. It does not indicate that all persons

FIG. 81.—*Operator at work in the orchard*

crave the power which they think the possession of money will give. Rather, it means a yearning for the self-respect which comes with the knowledge that the work accomplished is of recognized value. The reward sought is not power, but independence. Young persons, as well as older folk, are eager for, and need a certain amount of, the experience that is obtained by producing and selling a marketable product. A city boy has an ambition to sell newspapers because it gives him employment and makes him feel himself a part of the business world. Why should not the country boy have a like opportunity? A business enterprise that centers

in the farm has all the advantages of newspaper-selling and few of its disadvantages. Through contact with the business world, a money-earning industry for young persons on the farm should broaden their interests, should aid in keeping them out of community ruts, and should present farm life in its right perspective.

During the summer months there are many weeks when the boy and the girl on the farm have little to do. If those weeks were occupied in planning, organizing, and conducting an enterprise that would bring money returns, time often wasted might be used wisely, since business experience and training would be gained.

The complaint is being made that young persons are leaving the farm for the city. In some cases their action is justified, since no employment has been provided for them that yields adequate compensation. Helping with the farm work has afforded the only opportunity for boys and girls to gratify a natural craving for adventure and execution, and, unfortunately, service on the home farm has too seldom provided a tangible return.

Such an enterprise might consist in developing a small business for the disposal of products that often are wasted. Consider the bushels of fruit that rot on the ground every year. In apples alone there is a tremendous economic loss. Cherries, pears, plums, and grapes often go to waste because they ripen too quickly to be marketed, because the market is overcrowded, or because the farmer is engaged in other work and has no time to attend to the fruit. This unmarketable material might be gleaned by the young persons on the farm, and be made to form the basis for a small, but profitable, industry.

CANNING CLUBS IN SOUTHERN STATES

In the southern States there are canning clubs, the success of which may be taken as an indication of what could be expected from similar work in our own State. For example, tomato clubs, which have been organized by the Federal Government, provide an industry for boys and girls on the farm and utilize bushels of tomatoes that formerly were wasted. Canning begins only when shipping tomatoes to northern markets is no longer profitable. Canning outfits are set up in the fields, and the canning process, which is carried on out of doors, is supervised by a trained person. Tomatoes are canned in tin, and the finished product is marked by a standard label which is a kind of guarantee of the excellence of the product. Thus, by canning tomatoes, club members are able to obtain returns on a large crop which otherwise would be a total loss. Not only does the enterprise bring its financial reward, but, what is still more important, the development of the young persons and their increased interest in farm life give to the South a return impossible of measurement.

These young persons who are being trained in business principles and business operations are becoming alert; they are developing keenness and ingenuity.

May there not be equal opportunities in New York State for an organization similar to that of the South, by which not only tomatoes, but also a great variety of other fruits, can easily be utilized for profit? If the Federal Government finds canning clubs worth developing in the southern States, is it not safe to assume that such clubs will be equally desirable in our own State? There are many home industries which might be built up by young persons on the farm, and it is to be hoped that such industries will gradually develop. The canning of products that would otherwise be wasted is an industry that should reach many homes. Young men as well as young women, boys as well as girls, mothers as well as daughters, may organize clubs and thus successfully develop this enterprise.

A CANNING EXPERIMENT ON A NEW YORK STATE FARM

It is not a theory that a lucrative canning business may be developed on the farm. The possibilities of such development have already been illustrated on one farm in New York State. The story of that enterprise is as follows:

A young farmer, who was intelligent, alert, and well-trained, found that drought and blight had injured the selling qualities of the year's peach and apple crops. While the fruit was sound, a large part of it was unsightly and rather small. The farmer had set a high standard for marketable produce and felt that he could not afford to lower the standard by selling inferior fruit. Accordingly he sought other means whereby the fruit could be profitably used. He pondered the matter, and finally came to the conclusion that the fruit should be canned and a market found for a superior grade of home-canned goods.

After the decision had been made, he set about finding means of realizing his plans. Various small buildings on the farm were carefully considered in order to determine where the work might best be conducted. Finally a part of the packing house, which was near the farmhouse and close to the orchard, was chosen. A study of apparatus was made, and cans, canners, various utensils, and stoves were obtained. A young woman, adequately trained, was employed to organize and begin the work. In the building were placed two stoves for cooking, a sink, and three long tables for holding either empty cans or the finished product. Two small canning outfits were purchased and set up out of doors near the packing house. Although the equipment was simple, it was sufficient for conducting the work.

When all was in readiness, a small company, consisting of the girl-organizer, a young man to do heavy lifting, and four young girls from neighboring farms who were employed by the day, began operations. Although they were unexperienced, yet the work progressed well. Full cans gradually replaced the empty ones. The following kinds of fruit were made:

Canned peaches, pears, and plums
Preserved peaches, pears, and plums
Marmalades and butters
Apple, crab-apple, and quince jellies
Pickled peaches and pears

FIG. 82.—*Every one becomes useful in the canning season*

The jars were arranged on the shelves in convincing array — well-canned, well-cleaned, and attractively labeled, and certain to stimulate the appetite of a possible consumer. It may be of interest to know how the work was done.

In the morning a supply of sirup was made for the day. Fifty pounds of sugar to thirty quarts of water was the proportion used. If sour plums were to be canned, the sirup was used as made; if prunes were to be canned, the sirup was diluted somewhat; and for peaches it was diluted slightly more than for prunes. After the sirup had been placed over the fire to cook, work began on the cans. Two girls did this part of the work together. The cans were first thoroughly washed and rinsed. If they were to be filled with hot, cooked fruit, such as butters, jams, marmalades, and preserves, which had previously been cooked in a kettle,

the cans were sterilized. Sterilization was accomplished by filling the big pans, or trays, of the canner with jars, placing the trays in the canner, and adding enough cold water to cover them. The fire was started, and the water was brought gradually to the boiling point and was allowed to boil for fifteen minutes. The hot fruit, butter, jam, or marmalade was poured into the sterile cans, and the cans were then sealed.

If, however, the fruit was to be *canned*, the jars were washed, rinsed and without further treatment turned top downward on the table on a clean cloth. When the fruit had been prepared the jars were nearly filled, the rubbers were adjusted, and sirup was poured over the fruit until the jars were full to overflowing. The covers were now placed on the cans and the clamps were adjusted, and the jars were sealed until they had been placed in the canner; then the clamps were loosened. This preliminary sealing was done in order that no sirup might be lost in carrying the trays of cans from the tables in the building to the canners out of doors, for the difficulty of carrying fifteen cans of fruit without losing some of the sirup was soon realized.

The time for cooking the fruit varied. For example, if pint cans were used in canning peaches, twenty to thirty minutes was a sufficient time for cooking the fruit; if quart cans were used, about thirty minutes was required for cooking; a two-quart can required cooking for thirty-five minutes, or even longer. Plums required a little less cooking than did peaches, and the time varied also with the condition of the plums. Before removing the jars of fruit from the canner, the clamps were fastened down, thus sealing the jars, and the fruit was cooked for five or ten minutes longer. A sufficient quantity of water was placed in the canner to cover the jars from the bottom to a depth of two to three inches. The temperature of the water was about the same as that of the sirup in the cans; otherwise the cans would probably have been broken.

After the fruit had been removed from the canner, it was placed on a long table used only for that purpose, and was allowed to remain there over night. On the second morning, while two of the girls were washing cans for use on that day, the others washed and wiped the outside of the cans containing fruit that had been canned the day before. The cans were then lowered on a dumb-waiter to the cellar, where long tiers of shelves had been provided for holding them.

The amount of fruit put up in a day varied greatly, according to the kinds made. If fruits were canned, the numbers were much larger than when preserves, marmalades, jams, and butters were made, since the latter required a long time for cooking. The largest number of receptacles filled in one day was 303; the smallest number was 93; the average was about 200 per day. The records for two days are given below:

Record for the first day

Amount of material used

$\left.\begin{array}{l}\text{10 pounds brown sugar}\\ \text{1 gallon vinegar}\\ \tfrac{1}{4}\text{ pound cloves}\end{array}\right\}$ for pickles

50 pounds sugar for sirup

8 pounds sugar for jelly

FIG. 83.—*Girls of the neighborhood were called in to help*

Output from material

179 quarts canned peaches

32 pints peach butter

40 pints canned plums

21 quarts pickled peaches

31 glasses plum and peach jellies

Total number of receptacles filled, 303

Record for the second day

Amount of material used

50 pounds sugar for sirup

28 pounds sugar for peach preserves

12 pounds sugar for crab-apple jelly

Output from material
- 41 glasses jelly
- 23 pints peach butter (left over from the day before)
- 17 pints peach preserves
- 12 quarts canned peaches

Total number of receptacles filled, 93

CANNING CLUBS FOR NEW YORK STATE

The following questions now arise: Is there an opportunity for the organization of canning clubs in New York State? Will the isolated

Fig. 84.—*The fruit shows the results of a busy season*

enterprise conducted by unexperienced persons have any chance of success? Canning clubs have proved successful in the South, and commercial canning has been successfully conducted on one farm in this State. While the profits yielded by the latter enterprise were not great, nevertheless they were sufficient to justify the belief that similar enterprises might furnish excellent opportunities for many young persons on other farms.

In order to encourage the work and to establish uniform standards of excellence, the Department of Home Economics will be glad to cooperate with interested persons who desire to have such clubs organized in their communities. If such an organization is to be in operation by the next canning season, it is necessary to begin planning at once. The young folk should be brought together and the enterprise should be suggested to them.

If interest is manifested in the movement, further details will be given in a later bulletin. The following suggestions are now offered as a tentative outline for organization:

1. Membership shall be open to boys and girls of twelve years of age or over. Housekeepers also are eligible to membership and may assist in directing the work.

2. A club shall consist of at least twelve members, with a maximum membership of fifty.

3. Club work shall be under the supervision of the Department of Home Economics, College of Agriculture, Ithaca, New York.

4. The fruits and the vegetables used shall be limited to cherries, peaches, pears, plums, apples, grapes, quinces, and tomatoes.

5. Only standardized recipes, furnished or approved by the Department of Home Economics, shall be used.

6. Only such goods as have received the approval of the representative of the Department of Home Economics shall receive the club label.

7. Clubs shall be responsible for marketing their products, but assistance will gladly be given by the Department in order to aid in establishing permanent markets.

In order to aid in the development of the above suggestions, the Department of Home Economics stands ready to send to a limited number of communities a club organizer who will assist in the enterprise in every possible way. Such assistance will consist of instruction for three days in principles of canning and methods to be used, suggestions for equipment, and investigation of local markets. The work of the organizer will be followed by that of a person sent from the Department, who will supervise the work of canning, standardize and label all products, and help with the packing. As has been stated, club labels will be used only on cans of a high standard of excellence in order that the club label may become a guarantee of standard goods in the future. It is equally important that uniform cans and jelly glasses shall be used by the clubs.

For the first year, the problem of marketing canned fruit will be the greatest; but, just as tomatoes canned in the South have found a place on the market, so it is hoped that a desire on the part of the public for New York State canning-club products will soon be manifest. Housekeepers who cannot do home canning are buying tinned goods. Will they not gladly buy fruit that is known to be wholesome and that has the delicate flavor retained by fruits canned in glass?

Success, not only in marketing but in every step of the enterprise, depends on the ambition of the young women and men in the country and on their determination to build up a profitable home industry. Are there such young persons in your community?

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L. H. Bailey, *Director*

Course for the Farm Home, Martha Van Rensselaer, *Supervisor*

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A CANNING BUSINESS FOR THE FARM HOME

DISCUSSION PAPER

This discussion paper may be returned with answers to the questions and with any suggestions of your own. While the answering of these questions is not absolutely necessary, much greater benefit will be derived if you share your own experience with others. It will also help us to understand your point of view. The lesson may be used in the grange and in the club where these subjects are considered.

1. About how much fruit goes to waste on your farm each year?

2. Do you think that canning clubs would be advantageous in the rural districts of the State?

3. Could a club be organized in your district?

Name ....

Address ....

Date...................

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 26 | ITHACA, N. Y. OCTOBER 15, 1912 | STOCK FEEDING SERIES No. 1

COMPUTING RATIONS FOR FARM ANIMALS

E. S. SAVAGE

Farming is a business. The details in regard to profit and loss should be studied as closely by the farmer as by any other manufacturer.

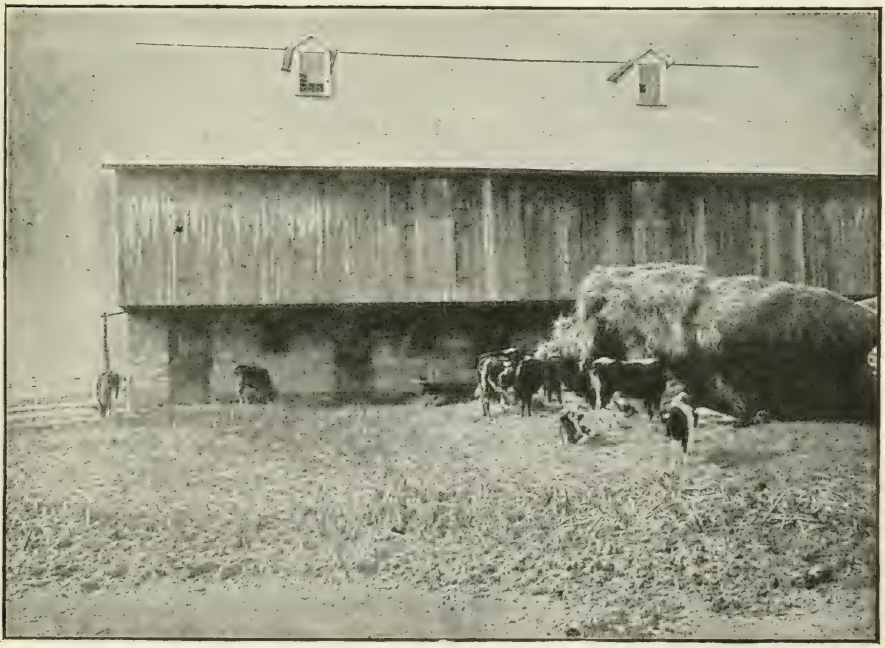

FIG. 1.—*Farming is a business. Old-time rations in which the straw stack played a large part must be improved*

One of the important parts of the farmer's business in the manufacture of his finished products for market is his feeding operations in the pro-

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duction of meat and milk and, in the case of the horse, the production of work. Too little attention has been paid to the proper compounding of rations to get the best returns in product from the money paid out for feed, whether that feed has been actually bought in the market or produced on the farm. Many farmers never set any price on the feeds produced on the farm, considering them merely as feeds procured at no money cost and therefore to be fed without regard to quantity or composition.

Instead of feeding in a haphazard manner, a farmer should know, at least approximately, the cost of producing his home-grown feeds, how to plan his rations in order to use these feeds to the best advantage, and how to buy intelligently the feeds on the market. This knowledge will enable him to calculate the most economical ration for the animal he wishes to feed, whether dairy cow, sheep, horse, or beef animal. It is the purpose of the present lesson on stock feeding to set forth, as clearly as possible in a brief lesson, a practical method of computing rations for stock. Before being able to compute a ration intelligently, however, it is necessary to know something of the composition of the animal body and of foods, in order to understand why foods should be grouped in certain proportions to constitute what is called a ration.

THE ANIMAL BODY

The body of any animal is made up of water and dry matter, and this water and dry matter must all come from the food.

Water in the animal body

The water in the animal body serves four purposes: first, it is a part of all bone and flesh; second, it serves as a carrier of food from the digestive tract, or from those parts of the body where the food is put into suitable shape to be used by the body cells, to those cells wherever they may be located; third, water serves to carry away the wastes of the body through the perspiration and the urine; fourth, it serves to equalize the temperature. This water in the body comes from the water that the animal drinks and from the water in the succulent parts of the food. The water in the animal body constitutes on an average about fifty per cent of the live weight.

The dry matter of the body

The dry matter of the body is made up of many chemical elements — for example, carbon, hydrogen, oxygen, nitrogen, sulfur, phosphorus, and perhaps half a dozen others. These elements are arranged in all sorts of combinations, to form the bones, flesh, hide, hair, hoofs, and other parts of the body. For the purpose of this discussion, in order to get a clear

understanding of the relation of the food to the body the dry matter may be divided into four groups of substances, namely, ash, nitrogenous substances, carbohydrates, and fats. The dry matter of the body is so grouped because this is the usual grouping of the chemical compounds that make up plants, and it is desired to study the relation of the groups in plants with the same groups in the body.

Ash.— The ash is the mineral part of the body. In determining the mineral part of any substance in the chemical laboratory the substance is completely burned and all the organic matter goes off in the form of gas, leaving behind the mineral matter in the form of ash. The ash of the body constitutes two to five per cent of the live weight. This mineral matter occurs mostly in the bones, but some is found in all the tissues.

Nitrogenous substances.— The nitrogenous parts of the body are known by various names, which are also applied to the nitrogenous substances in foods. Some of these names are protein, proteids, albuminoids. The term protein will here be used to designate all the nitrogenous substances of the body, the body products, and the food. Examples of the nitrogenous parts of the body are lean meat, skin, hoofs, horns, and hair; of the body products, wool, feathers, the albumen of eggs, and the curd of milk. In food, good examples of protein as such cannot be given, since the protein does not exist in any part of the plant in so nearly pure a state as it does in the hair, hoofs, or horns of the animal. The protein of the body is built up entirely from the protein of the food. The distinguishing characteristic of protein is that it contains nitrogen.

Carbohydrates.— The carbohydrates of the body and of the food are made up of carbon, hydrogen, and oxygen. Examples of common carbohydrates are sugar and starch.

Very few carbohydrate substances exist in the body, except in the blood. These substances are taken from the blood to furnish the energy of the muscles and part of the heat of the body. The liver acts as a storehouse of carbohydrates and regulates the supply to the blood so that the amount of carbohydrates in the blood is kept constant for properly supplying the muscles. It is also thought that the liver has the power to make carbohydrates from the fats and the protein of the food if the supply of carbohydrates is limited.

Fats.— The fats in the body are used to supply energy to the animal for work, and to furnish fuel for heating the body. The fats serve also as the storehouse of heat and energy; they are added to when the food supply is in excess of that needed by the animal for its work or production, and they are drawn upon when the food supply is short. Fats have the same function that carbohydrates have except that they are more concentrated, supplying about $2\frac{1}{4}$ times as much energy to the

animal as does the same weight of carbohydrates or of protein. Fat is too well known to need illustration.

DEMANDS OF THE ANIMAL FROM ITS FOOD

Requirements for maintenance of tissues

Animals need food to maintain their existence, which is dependent on matter and energy. As shown above, the dry matter of the body is made up of ash, protein, carbohydrates, and fats. The part of the body that is more or less permanent is that made up of ash and protein, while the carbohydrates and fats are more changeable and have to do more with

FIG. 2.—*One use of the energy in food: the power to do work*

the energy of the body. However, the tissues are constantly being worn out, and must be replaced, and this requires a new supply of ash and protein from the food.

Besides the ash and protein constantly being replaced in the mature animal, the growing animal must have matter to form new tissue and the productive animal must have matter for products such as milk, eggs, wool, and the like, all of which contain ash, fat, protein, and carbohydrates. Then, in the pregnant female, ash, fat, protein, and carbohydrates are needed for the growth of the young.

Requirements for energy

After this matter has been supplied from the food for the maintenance of the dry matter of the body, there is a still further demand on the food

to furnish energy to the animal for various uses. First, the temperature of the animal body must be about 100° F. and, while the temperature of the surrounding air may vary all the way from — 20° to + 90° F., this body temperature must be kept practically constant, requiring considerable energy in the form of heat; second, energy is required to keep up all the changes in the body in preparing food for use by the body, to take that food where it is needed, and to carry out waste matter from the body; third, energy is needed to manufacture products such as milk, wool, eggs, and the like; fourth, energy is needed to enable the animal to do work, as in the case of the horse.

All the uses to which the matter and energy of food are put are summed up in the following table:

USES OF THE MATTER AND THE ENERGY OF FOOD

1. To support life..............	a. To maintain body temperature b. To repair waste tissues c. To form new tissues d. For the muscular activity of the vital processes
2. To reproduce life	
3. To yield some product.........	a. Stored up as fat or flesh in the tissue b. Secreted in the form of milk or wool
4. To perform labor	

Requirements of the body for water

In addition to the requirements for maintenance of tissues and for energy the body requires a supply of water daily, in order to keep up the water content of the body and to provide a medium for the transfer of the food material from different parts of the body to other parts and for the elimination of waste matter.

How the food fulfills these requirements

Like the body, the common coarse foods, grains, meals, and feedstuffs in general used for animals are made up of the following groups of constituents:

Water		
Dry matter	Ash	
	Nutrients	Protein (nitrogenous) Carbohydrates (fiber, nitrogen-free extract) Fats

Water.— The use of the water in the food has already been indicated.

Ash.— The ash required by the animal does not need to be computed carefully because all the ordinary foods furnish it in sufficient amount, provided a good variety is given and plenty of salt is supplied. Corn is slightly deficient in ash, but in the ordinary ration the foods fed with corn make up for this deficiency.

Protein.— The protein, carbohydrates, and fats in food are commonly spoken of as the nutrients of the dry matter, since it is from those groups

FIG. 3.—*Another use of the energy and matter in food, stored in the body as flesh and fat for the future use of man*

of constituents that animals derive the matter and energy necessary for the uses already enumerated. The protein is used to keep up the protein of the body — that is, to replace worn-out tissues, to build up new tissues, for growth of hair, hoofs, horns, and the like. A very important fact in this connection is that any protein in the ration in excess of that required for keeping up the nitrogenous tissues of the body can be used by any animal for the production of heat and energy. On the other hand, while protein can be used thus for the production of heat and energy, thus serving the purpose of carbohydrates and fat, protein cannot be produced from the carbohydrates or the fats of foods. Therefore it is always necessary to have a sufficient amount

of protein in the ration. The discussion of the necessary amount of protein for different uses will be taken up later under "Feeding standards."

The amount of digestible protein in the food varies within somewhat wide limits. The percentage varies from 1 per cent in succulent foods, such as mangels, through 7.1 per cent for red clover hay and 8.5 per cent among the cereals, to as high as 37.6 per cent for cottonseed meal. Thus it is seen that there is a large list from which to choose in regulating the amount of protein in a ration.

Carbohydrates.— The carbohydrates are divided by the chemists into what are called "crude fiber" and "nitrogen-free extract," because the crude fiber is less digestible than the other carbohydrate material. In a fodder analysis the ash, protein, fat, and fiber are first determined. Their sum is then subtracted from the total dry matter, and the result is called "nitrogen-free extract." This term includes all the carbohydrates except the fiber. The digestible nitrogen-free extract and digestible fiber have the same food value for all practical purposes and perform the same work in the nutrition of the animal. This work consists mainly in furnishing energy for whatever use the animal may need it. If there is more energy provided in the ration than is needed at that particular time, the excess energy may be stored in the body as fat.

The amount of fiber and nitrogen-free extract in the foods, taken together, varies as much as does the protein, but there is always a relatively larger amount of carbohydrates than of protein. In every case, when there is a low percentage of protein there is a high percentage of carbohydrates.

Fats.— The food fats are used by the animal in about the same way as are the carbohydrates. They provide energy to be used in any way that the animal needs, and if the animal has more energy than is needed it may be stored in the form of fat. The fat, however, has an energy value equal to about $2\frac{1}{4}$ times the energy value of the same weight of carbohydrates.

The amount of digestible fat in the different foods varies without respect to the other constituents. It is low in the coarse fodders, running up to 11.6 per cent in distillers' dried grains.

Summary of the requirements of the body and the relation of the constituents of the food to these requirements

The animal body may be likened to a steam engine. The engine must have three things to keep it going: First, it must have repair material; if any part of the engine or boiler gives out it must be repaired at once.

Second, it must have water supplied to it, in order to have a medium by which the energy of the fuel may be transferred to the engine. Third, it must have fuel, to yield up energy to do work; energy is the power to do work.

In the same way the body must have three things supplied to it: First, it must have repair material, as has been explained. For this repair material a certain amount of protein must be supplied in the food. In contrast with the engine, when the body is given more repair material

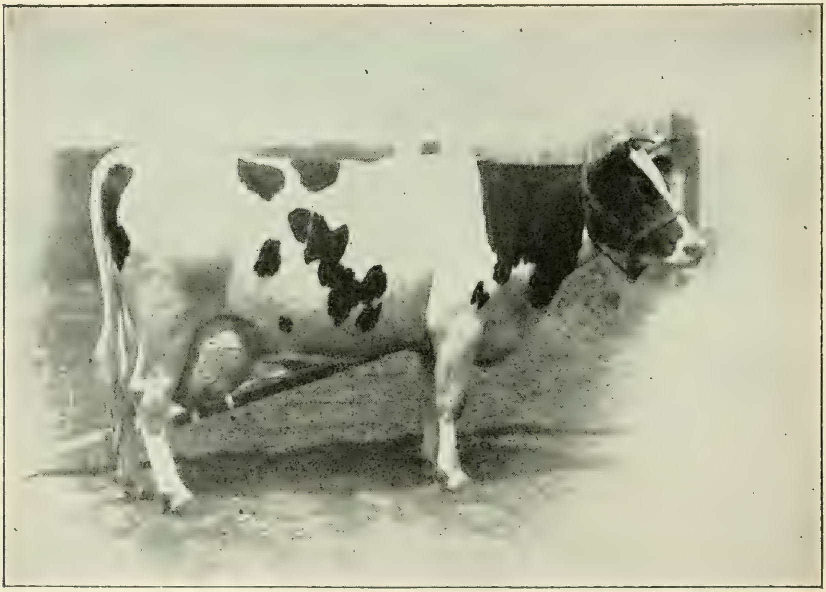


FIG. 4.—*An animal may be likened to an engine. Besides maintaining herself and making her own repairs, this cow has manufactured from the matter and energy in her food over 500 pounds of butter in one year*

(protein) than is needed the residue may be used for building new parts or to produce energy. Second, the body must have a sufficient amount of water, to aid in forming bones and new tissue, in the circulation of food material, and in the withdrawal of waste material. This water is supplied directly and in the succulent part of food. Third, the body requires energy, as we have seen, to do its inside construction work, to perform labor, to make milk, and so on. This energy is derived largely from the carbohydrates and fat, and partly from the protein, in the food.

To carry the analogy a little further: The engine and the boiler do not turn all the energy derived from fuel into power, but a good deal of

the heat is lost into the air; in the same way energy is lost in the vital processes of the body and in keeping up the body heat.

Then, the boiler loses part of the heat in the ashes; that is, the fuel is not completely consumed. This brings up the matter of digestibility of food by the body.

Digestibility of food.— All the protein, fiber, nitrogen-free extract, and fat in the food is not available to the animal for use by the body. Certain parts of each of the food constituents are undigested and pass out of the body in the manure. In computing rations, only the digestible constituents of the foods will be considered. The digestible part of each of the constituents, protein, carbohydrates, and fat, has been carefully determined by digestion experiments. These percentages are shown in Table 1 and may be compared with the total constituents, which are given in the same table.

After this discussion of the composition of the animal body and of the food, the compounding of rations to meet the demands of the body can now be taken up more intelligently.

TABLE 1. COMPOSITION OF FOODS (IN POUNDS)

(Compiled mainly from "Feeds and Feeding," by W. A. Henry)

In 100 pounds	Water	Ash	Protein		Carbohydrates				Fat	
					Fiber		Nitrogen-free extract			
			Total	Digestible	Total	Digestible	Total	Digestible	Total	Digestible
SUCCULENT ROUGHAGE										
Fodder corn	79.3	1.2	1.8	1.0	5.0	3.0	12.2	8.9	0.5	0.4
Peas and oats	79.7	1.6	2.4	1.8	6.1	3.7	9.6	6.5	0.6	0.4
Peas and barley	80.0	1.6	2.8	2.1	6.8	3.5	8.2	5.6	0.6	0.4
Red clover	70.8	2.1	4.4	2.9	8.1	4.0	13.5	9.6	1.1	0.7
Alfalfa	71.8	2.7	4.8	3.6	7.4	3.2	12.3	8.9	1.0	0.4
Hungarian grass	71.1	1.7	3.1	2.0	9.2	6.4	14.2	9.5	0.7	0.4
Millet	80.2	1.0	1.5	0.8	6.5	4.0	10.5	7.0	0.3	0.2
Green sorghum	79.4	1.1	1.3	0.6	6.1	3.5	11.6	8.1	0.5	0.3
Potatoes	79.1	0.9	2.1	1.1	0.4	......	17.4	15.7	0.1	0.1
Mangel beets	90.9	1.1	1.4	1.0	0.9	0.3	5.5	5.2	0.2	0.2
Sugar beets	86.5	0.9	1.8	1.3	0.9	0.3	9.8	9.5	0.1	0.1
Carrots [1]	88.6	1.0	1.1	0.8	1.3	0.7	7.6	7.0	0.4	0.3
Flat turnips	90.1	0.9	1.3	0.9	1.2	0.6	6.3	5.8	0.2	0.1
Rutabagas	88.6	1.2	1.2	1.0	1.3	1.0	7.5	7.1	0.2	0.2
Cabbages [2]	90.0	0.8	2.6	2.3	0.9	0.8	5.5	5.1	0.2	0.1
Pumpkins	90.9	0.5	1.3	1.0	1.7	1.1	5.2	4.7	0.4	0.2
Apples [3]	80.7	0.4	0.7	0.5	1.2	0.4	16.6	16.1	0.4	0.2
Apple pomace	83.0	0.6	1.0	0.6	2.9	1.9	11.6	9.9	0.9	0.4
Corn silage [4]	73.6	2.1	2.7	1.4	7.8	5.0	12.9	9.2	0.9	0.7
Pea-vine silage [5]	76.8	1.3	2.8	2.1	6.5	3.9	11.3	9.2	1.3	0.8

[1] Digestion coefficients of turnips were used.
[2] Digestion coefficients of dwarf Essex rape were used.
[3] Digestion coefficients of sugar beets were used.
[4] Digestion coefficients. 1906, Lindsey and Smith. Mass. (Hatch) Expt. Sta. Rpt.
[5] Digestion coefficients of cow peas, ready for soiling, were used.

TABLE 1 — (*Continued*)

In 100 pounds	Water	Ash	Protein		Carbohydrates				Fat	
					Fiber		Nitrogen-free extract			
			Total	Digestible	Total	Digestible	Total	Digestible	Total	Digestible
DRIED ROUGHAGE										
Timothy hay	13.2	4.4	5.9	2.8	29.0	14.5	45.0	27.9	2.5	1.3
Red clover hay	15.3	6.2	12.3	7.1	24.8	13.4	38.1	24.4	3.3	1.8
Alfalfa hay	8.2	8.8	14.6	10.5	28.9	13.6	37.4	26.9	2.1	0.9
Mixed grasses and clover	12.9	5.5	10.1	5.8	27.6	16.6	41.3	25.2	2.6	1.3
Hungarian hay	7.7	6.0	7.5	4.5	27.7	18.8	49.0	32.8	2.1	1.3
Millet hay [1]	16.0	4.3	6.5	2.0	28.0	17.6	43.4	24.3	1.8	0.9
Corn fodder	42.2	2.7	4.5	2.5	14.3	9.3	34.7	25.3	1.6	1.2
Corn stover	40.5	3.4	3.8	1.4	19.7	12.6	31.5	18.6	1.1	0.7
Dried sorghum [2]	11.1	8.9	6.3	2.7	30.1	14.8	41.7	25.5	1.9	1.2
Oat straw	9.2	5.1	4.0	1.3	37.0	20.0	42.4	19.5	2.3	0.8
Wheat straw	9.6	4.2	3.4	0.8	38.1	19.1	43.4	16.1	1.3	0.4
Pea-vine straw [3]	7.1	6.8	9.8	5.9	23.3	12.1	51.3	33.8	1.7	0.8
Bean straw [4]	8.9	6.7	6.7	4.0	33.0	17.2	43.8	28.0	0.9	0.4

[1] Composition. 1896, C. S. Crocker. Mass. (Hatch) Expt. Sta. Rpt.
Digestion coefficients. 1906, Lindsey and Smith. Mass. (Hatch) Expt. Sta. Rpt.
[2] Composition. 1900, Thatcher. Nebr. Agr. Expt. Sta. Rpt.
Digestion coefficients. 1904, Headden. Colo. Agr. Expt. Sta. Bul. 93.
[3] Composition. 1909, Bitting. U. S. Dept. Agr., Bur. Chem. Bul. 125.
[4] Composition. 13th Annual Rpt., N. Y. (Geneva) Expt. Sta.
Digestion coefficients of pea-vine straw were used.

In 100 pounds	Water	Ash	Protein		Carbohydrates				Fat	
					Fiber		Nitrogen-free extract			
			Total	Digestible	Total	Digestible	Total	Digestible	Total	Digestible
CONCENTRATES										
Corn (dent)	10.6	1.5	10.3	7.8	2.2	1.3	70.4	65.5	5.0	4.3
Corn and cob meal	15.1	1.5	8.5	4.4	6.6	3.0	64.8	57.0	3.5	2.9
Hominy chop	9.6	2.7	10.5	6.8	4.9	3.3	64.3	57.2	8.0	7.4
Gluten feed	9.2	2.0	25.0	21.3	6.8	5.2	53.5	47.6	3.5	2.9
Distillers' dried grains	7.6	2.0	31.2	22.8	11.6	11.0	35.4	28.7	12.2	11.6
Oats	10.4	3.2	11.4	8.8	10.8	3.3	59.4	45.7	4.8	4.3
Wheat [1]	10.5	1.8	11.9	10.0	1.8	0.8	71.9	66.1	2.1	1.[illegible]
Wheat bran	11.9	5.8	15.4	11.9	9.0	3.7	53.9	38.3	4.0	2.5
Wheat middlings	10.0	3.2	19.2	16.9	3.2	1.2	59.6	52.4	4.8	4.1
Red-dog flour	8.5	2.6	18.4	16.2	3.0	1.1	63.5	55.9	4.0	3.4
Barley	10.8	2.5	12.0	8.4	4.2	2.1	68.7	63.2	1.8	1.6
Malt sprouts	9.5	6.1	26.3	20.3	11.6	9.6	44.9	36.4	1.6	1.4
Brewers' wet grains	75.7	1.0	5.4	3.9	3.8	1.5	12.5	7.8	1.6	1.4
Brewers' dried grains	8.7	3.7	25.0	20.0	13.6	6.8	42.3	25.4	6.7	6.0
Rye [2]	8.7	2.1	11.3	9.5	1.5	0.8	74.5	68.5	1.9	1.2
Rye bran [3]	11.8	3.4	14.6	11.2	3.5	1.4	63.9	45.4	2.8	1.8
Buckwheat	13.4	2.0	10.8	8.1	11.7	2.8	59.7	45.4	2.4	2.4
Buckwheat bran	8.2	4.9	12.6	5.9	32.9	12.8	37.9	21.2	3.5	2.0
Buckwheat middlings	12.8	5.0	26.7	22.7	4.4	0.7	44.3	36.8	6.8	6.1
Culled beans	14.1	3.1	25.1	22.6	9.4	5.8	46.7	43.9	1.6	1.6
Canada field peas [4]	15.0	2.4	23.7	19.7	7.9	2.1	50.2	47.2	0.8	0.4
Cottonseed meal	7.0	6.6	45.3	37.6	6.3	2.2	24.6	19.2	10.2	9.6
Linseed oil meal	9.8	5.5	33.9	30.2	7.3	4.2	35.7	27.8	7.8	6.9
Wet beet pulp	89.8	0.6	0.9	0.5	2.4	1.8	6.3	5.9	....	.....
Dried beet pulp	8.4	4.5	8.1	4.1	17.5	12.6	60.8	52.3	0.7	.....
Sugar molasses	25.9	6.3	2.7	1.4	....	....	65.1	59.2	....	.....
Skimmed milk	90.6	0.7	3.1	2.9	....	....	5.3	5.3	0.3	0.3
Buttermilk	90.2	0.7	4.0	3.8	....	....	[illegible]	3.9	1.1	1.0

[1] Digestion coefficients. 1909, Chamberlain. U. S. Dept. Agr., Bur. Chem. Bul. 120.
[2] Digestion coefficients of barley were used.
[3] Digestion coefficients of wheat bran were used.
[4] Digestion coefficients of pea meal were used.

COMPUTING A RATION

The nutritive ratio

Investigators and practical feeders alike have found that there is a certain relation between the protein and the carbohydrates and fat in the best rations. This relation is called the "nutritive ratio." The ratio is always expressed as the amount of carbohydrates and fat that there is in a given food or ration compared with one pound of protein. In order to find the second term of the nutritive ratio in any given food or ration, multiply the digestible fat by $2\frac{1}{4}$ for the reason given on page 7; add the digestible fiber and digestible nitrogen-free extract; and divide the result by the digestible protein. For example, the nutritive ratio of fodder corn is found by Table 1 to be 1:12.8. This means that in fodder corn the relation of the protein to the carbohydrates and fat is as 1:12.8; or, that fodder corn has twelve and eight tenths times as much carbohydrates and fat as protein.

The relation of the protein to the carbohydrates and fat has been calculated in each of the foods in Table 3 and will aid in the choice of foods to properly balance a ration. A knowledge of the nutritive ratio of a food serves to tell at a glance whether that food is high or low in protein.

The calculation of the nutritive ratio of a ration as a whole serves as a check on the ration, to denote whether it is suited for the purpose intended, as will be shown later.

A food or ration having a nutritive ratio of less than 1:6 is spoken of as having a "narrow" nutritive ratio; if the ratio is above 1:6 the ration or food is said to have a "wide" nutritive ratio. These terms are purely relative, but serve in a rough way to distinguish the different kinds of foods and rations.

Feeding standards

The requirements of animals as to amount of necessary nutrients for such purposes as milk production, beef production, labor production, and the like, as well as the relation between these nutrients, have been the subject of much inquiry. Investigators have sought to put those requirements into definite form. They have given to this table of requirements the name "feeding standards." The standards are merely a statement of the necessary amount of nutriment required by an animal for a given purpose for a certain length of time. They are based on the requirements for 1,000 pounds live weight in 24 hours. The requirements are usually stated in terms of dry matter, digestible protein, digestible carbohydrates (fiber plus nitrogen-free extract), and digestible fat. The nutritive ratio for the given purpose for which the animal is to be fed is stated. With a view of shortening the computation of the ration as much as possible,

the standards in Table 2 are given in terms of dry matter, digestible protein, and total nutriment. In order to obtain the total nutriment, the fat has been multiplied by $2\frac{1}{4}$ and the carbohydrates and protein added.

Factors in an ideal ration

In actually computing a ration for a given purpose there are seven factors that should be considered:

1. Amount of dry matter
2. Digestibility of the ration
3. The nutritive ratio
4. Variety in the ration
5. Suitability of the foods to the animal
6. Palatability of the ration
7. Cost of the ration

Amount of dry matter.— In the table of feeding standards, the amount of dry matter has been indicated for each purpose to be served. The amount of dry matter in the ration serves to regulate the relative amounts of roughage and concentrates. By roughage are meant the coarser foods, such as hay, corn fodder, silage; by concentrates are meant the grains, and the other foods in the ration that are low in their percentage of fiber and water and high in their percentage of total nutriment. Ordinarily, in rations for cattle and sheep, if two thirds of the dry matter is from foods classed as roughage and one third from concentrates, the ration will be bulky enough to distend the digestive organs so as to give the best results. For horses and swine, more dry matter should be in the grain.

Digestibility of the ration.— A little more than two thirds of the dry matter in the ration should be digestible; that is, the amount of total nutriment should be at least two thirds as much as the dry matter. This relation will change with the purpose of the ration and with the character of the food. Any ration for productive purposes, however, which shows that the amount of total nutriment is less than two thirds as much as the amount of dry matter, can be improved.

The nutritive ratio.— In Table 2 the nutritive ratio for each purpose has been indicated. It will be noticed that the rations for growing animals and for milk production are 1:6 or narrower, while the rations for fattening and for labor may be somewhat wider. In none of the rations except in the case of the youngest animals does the nutritive ratio go below 1:4.5. Formerly, it was thought that feeders must calculate the nutritive ratio, or " balance " the ration, with much exactness. This is no longer considered to be necessary, due to further knowledge in respect to the function of the nutrients and to the fact that the nutrient protein is not so expensive as in former years. If the nutritive ratio given for the purpose is considered to be the widest ration for the best results,

and if no ration is made narrower than 1:4.5 except in the case of the youngest animals, which are growing new tissue very rapidly, the ration will be satisfactory.

Variety in the ration.— All feeders of animals should provide variety in the ration. Variety stimulates the animal's appetite. Better results are obtained from a ration containing several foods than from a ration limited in variety. If a ration for a dairy cow is made up from foods derived from three different plants, it will ordinarily have sufficient variety provided so that there are two different foods in the roughage and three foods in the concentrated part of the ration. Other classes of animals do not seem to need so much variety, although it is wise to supply it with all classes.

Suitability of the foods to the animal.— The foods in the ration should be suited to the animal and to the purpose for which the animal is fed. For example, wheat bran is not suitable for feeding hogs because of its bulk; wheat middlings are much to be preferred.

Palatability of the ration.— The ration should be palatable if the best results in production are to be obtained. With dairy cows palatability is easily secured by providing succulent food in the ration. The condition of the food has much to do with its palatability. No musty nor damaged food should be fed to any animal.

Cost of the ration.— Without doubt, this is the most important factor to be considered by the farmer. However, the other factors must not be sacrificed for cost in every case. A rough way, efficient in most cases, to choose foods for the greatest economy in the ration is to calculate the cost of one pound of total nutriment in the different foods available, then to choose those that will yield total nutriment the cheapest — always taking into consideration the six other factors that have just been explained.

A ration for a dairy cow illustrating the above factors.— A ration is desired for a cow weighing 1,000 pounds and yielding daily 30 pounds of milk testing 3.7 per cent butter fat. According to Table 2, the ration

TABLE 2. FEEDING STANDARDS

(Based on Wolff-Lehmann and Haecker standards. For one day and 1,000 pounds live weight)

	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × $2\frac{1}{4}$)] (pounds)	Nutritive ratio
Horses:				
Light work	20	1.5	11.9	1 : 6.9
Medium work	24	2.0	14.4	1 : 6.2
Heavy work	26	2.5	17.6	1 : 6.0

TABLE 2 — (*Continued*)

	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
Fattening cattle:				
First period	30	2.5	18.6	1 : 6.4
Second period	30	3.0	19.1	1 : 5.4
Third period	26	2.7	19.3	1 : 6.1
Sheep:				
Coarse wool	20	1.2	12.2	1 : 9.2
Fine wool	23	1.5	14.2	1 : 8.5
Breeding ewes:				
With lambs	25	2.9	19.0	1 : 5.6
Fattening sheep:				
First period	30	3.0	19.1	1 : 5.4
Second period	28	3.5	19.4	1 : 4.5
Brood sows	22	2.5	18.9	1 : 6.6
Fattening swine:				
First period	36	4.5	31.1	1 : 5.9
Second period	32	4.0	29.1	1 : 6.3
Third period	25	2.7	21.6	1 : 7.0
Growing horses, 6 months to 2½ years*	18	1.7	12.0	1 : 6.1
Growing cattle, dairy:				
Age in months, 2– 3	23	4.0	21.5	1 : 4.4
3– 6	24	3.0	18.1	1 : 5.0
6–12	27	2.0	15.6	1 : 6.8
12–18	26	1.8	15.2	1 : 7.4
18–24	26	1.5	14.2	1 : 8.5
Growing cattle, beef:				
Age in months, 2– 3	23	4.2	21.7	1 : 4.2
3– 6	24	3.5	19.7	1 : 4.6
6–12	25	2.5	17.3	1 : 5.9
12–18	24	2.0	15.6	1 : 6.8
18–24	24	1.8	14.7	1 : 7.2
Growing sheep, wool:				
Age in months, 4– 6	25	3.4	20.4	1 : 5.0
6– 8	25	2.8	18.0	1 : 5.4
8–11	23	2.1	14.7	1 : 6.0
11–15	22	1.8	13.9	1 : 6.7
15–20	22	1.5	13.0	1 : 7.7
Growing sheep, mutton:				
Age in months, 4– 6	26	4.4	21.9	1 : 4.0
6– 8	26	3.5	20.1	1 : 4.7
8–11	24	3.0	18.4	1 : 5.1
11–15	23	2.2	15.9	1 : 6.2
15–20	22	2.0	14.9	1 : 6.5
Growing swine, breeding stock:				
Age in months, 2– 3	44	7.6	37.9	1 : 4.0
3– 5	35	4.8	28.9	1 : 5.0
5– 6	32	3.7	25.9	1 : 6.0
6– 8	28	2.8	22.2	1 : 6.9
8–12	25	2.1	17.9	1 : 7.5
Growing swine, fattening stock:				
Age in months, 2– 3	44	7.6	37.9	1 : 4.0
3– 5	35	5.0	29.9	1 : 5.0
5– 6	33	4.3	28.0	1 : 5.5
6– 8	30	3.6	25.0	1 : 5.9
8–12	26	3.0	22.0	1 : 6.3

* Based on unpublished data of three years practice in raising colts.

TABLE 2 — (*Concluded*)

	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
Milking cows:*				
For maintenance	....	.700	7.925	....
For product in addition to maintenance:				
For 1 lb. of milk testing 2.5 per cent fat	....	.0527	.2574	....
2.6	....	.0535	.2629	....
2.7	....	.0543	.2685	....
2.8	....	.0551	.2743	....
2.9	....	.0559	.2812	....
3.0	....	.0567	.2870	....
3.1	....	.0575	.2928	....
3.2	....	.0583	.2987	....
3.3	....	.0591	.3055	....
3.4	....	.0599	.3115	....
3.5	....	.0608	.3185	....
3.6	....	.0616	.3243	....
3.7	....	.0624	.3312	....
3.8	....	.0632	.3369	....
3.9	....	.0640	.3428	....
4.0	....	.0648	.3497	....
4.1	....	.0656	.3555	....
4.2	....	.0664	.3612	....
4.3	....	.0672	.3671	....
4.4	....	.0680	.3729	....
4.5	....	.0689	.3787	....
4.6	....	.0697	.3842	....
4.7	....	.0705	.3890	....
4.8	....	.0713	.3945	....
4.9	....	.0721	.3992	....
5.0	....	.0729	.4048	....
5.1	....	.0737	.4105	....
5.2	....	.0745	.4150	....
5.3	....	.0753	.4209	....
5.4	....	.0761	.4253	....
5.5	....	.0770	.4311	....
5.6	....	.0778	.4355	....
5.7	....	.0786	.4413	....
5.8	....	.0794	.4469	....
5.9	....	.0802	.4517	....
6.0	....	.0810	.4572	....
6.1	....	.0818	.4619	....
6.2	....	.0826	.4676	....
6.3	....	.0834	.4721	....
6.4	....	.0842	.4791	....
6.5	....	.0851	.4835	....
6.6	....	.0859	.4882	....
6.7	....	.0867	.4926	....
6.8	....	.0875	.4984	....
6.9	....	.0883	.5040	....
7.0	....	.0891	.5075	....

* In rations for milking cows there should be not less than 24 pounds of dry matter. The nutritive ratio should be not wider than 1:6 nor narrower than 1:4.5. About two thirds of the dry matter in the ration should come from the roughage and one third from the grain, except in the case of the heaviest producers, when relatively more may come from the grain (see page 1574).

must contain 24 pounds or more of dry matter (see footnote to table), in which, for the maintenance of her body, this cow will require .700 pound of protein and 7.925 pounds of total nutriment. In addition to maintenance, she will require .0624 pound protein and .3312 pound total nutriment for the production of one pound of milk testing 3.7 per cent fat; for 30 pounds of milk she would require 30 times these amounts. Her total requirements will be as follows:

	Protein	Total nutriment
For maintenance	.700	7.925
For 30 pounds of milk, 3.7 per cent fat	1.872	9.936
Total	2.572	17.861

17.861 (pounds of total nutriment) — 2.572 (pounds of protein) = 15.289 (pounds of carbohydrates + [$2\frac{1}{4}$ x fat]). 15.289 ÷ 2.572 (pounds of protein) = 5.9. Therefore the nutritive ratio of the required ration must be not wider than 1 : 5.9. The protein in the ration must total not less than 2.572 pounds, and there must be digestible protein, fiber, nitrogen-free extract, and fat multiplied by $2\frac{1}{4}$, to total 17.861 pounds.

A combination of foods suitable for a dairy cow, in sufficient quantity to yield total nutriment and protein in the above amounts, must now be found. It will be assumed that at the price at which a farmer can buy his foods or raise them, he will find that red clover hay, corn silage, corn and cob meal, gluten feed, and cottonseed meal will yield him his total nutriment the cheapest.

A cow will eat in twenty-four hours, when fed the right proportion of roughage and concentrates, about one pound of hay and three pounds of corn silage to each one hundred pounds of live weight. In order to meet the requirements of the feeding standard when fed the above amount of roughage, she will need about one pound of grain to three pounds of milk.

In order to have the nutritive ratio 1 : 5.9 in the ration, about equal parts of grains below twenty per cent digestible protein and of grains above twenty per cent digestible protein will be found necessary. In the ration suggested above, corn and cob meal has been chosen for the grain below twenty per cent digestible protein, and gluten feed and cottonseed meal have been chosen for the grains above twenty per cent digestible protein. If it were necessary to have a narrower nutritive ratio, more foods having a high protein content would be included; if a wider ration were desired, more carbohydrate foods would be used. Calculating in detail from Table 1, the amounts of dry matter, digestible nutrients,

and total nutriment in the several foods in the suggested ration are as follows:

Food	Dry matter	Digestible protein	Digestible fiber	Digestible nitrogen-free extract	Digestible fat	Total nutriment
10 lbs. red clover hay	8.47	.710	1.340	2.440	.180	4.895
30 lbs. corn silage	7.92	.420	1.500	2.760	.210	5.153
5 lbs. corn and cob meal	4.25	.220	.150	2.850	.145	3.546
4 lbs. gluten feed	3.63	.852	.208	1.904	.116	3.225
1 lb. cottonseed meal	.93	.376	.022	.192	.096	.806
Total	25.20	2.578	3.220	10.146	.747	17.625

The nutritive ratio of the above ration may be calculated by subtracting the protein from the total nutriment and dividing the remainder, which is the carbohydrates plus the fat multiplied by $2\frac{1}{4}$, by the protein:

$17.625 - 2.578 = 15.047$

$15.047 \div 2.578 = 5.8$

Therefore the nutritive ratio is 1:5.8, which is correct, since it was said on page 16 that the ration must be not wider than 1:5.9.

By another method, the fat may be multiplied by $2\frac{1}{4}$, the fiber and nitrogen-free extract added, and the total divided by the protein:

$.747 \times 2\frac{1}{4} = 1.681$

$1.681 + 10.146 + 3.220 = 15.047$

$15.047 \div 2.578 = 5.8$

The result, 1:5.8 for the nutritive ratio, is of course exactly the same.

A shorter method is by Table 3, which has been compiled from Table 1 in order to shorten the work of computing rations. The total nutriment has been calculated for different amounts of the several foods. Instead of computing the ration in detail, as above, it may be computed with the aid of Table 3 as follows:

TABLE 3. DIGESTIBLE COMPOSITION OF STATED AMOUNTS OF COMMON FOODS
(Compiled from Table 1)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × $2\frac{1}{4}$)] (pounds)	Nutritive ratio
SUCCULENT ROUGHAGE					
Fodder corn	1	.207	.010	.138	1 : 12.8
	5	1.035	.050	.690	
	15	3.105	.150	2.070	
	20	4.140	.200	2.760	
	25	5.175	.250	3.450	
	30	6.210	.300	4.140	
	35	7.245	.350	4.830	
	40	8.280	.400	5.520	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × $2\frac{1}{4}$)] (pounds)	Nutritive ratio
SUCCULENT ROUGHAGE—(*Cont.*)					
Peas and oats................	1	.203	.018	.129	1 : 6.2
	5	1.015	.090	.645	
	15	3.045	.270	1.935	
	20	4.060	.360	2.580	
	25	5.075	.450	3.225	
	30	6.090	.540	3.870	
	35	7.105	.630	4.515	
	40	8.120	.720	5.160	
Peas and barley..............	1	.200	.021	.121	1 : 4.8
	5	1.000	.105	.605	
	15	3.000	.315	1.815	
	20	4.000	.420	2.420	
	25	5.000	.525	3.025	
	30	6.000	.630	3.630	
	35	7.000	.735	4.235	
	40	8.000	.840	4.840	
Red clover..................	1	.292	.029	.181	1 : 5.2
	5	1.460	.145	.905	
	15	4.380	.435	2.715	
	20	5.840	.580	3.620	
	25	7.300	.725	4.525	
	30	8.760	.870	5.430	
	35	10.220	1.015	6.335	
	40	11.680	1.160	7.240	
Alfalfa......................	1	.282	.036	.166	1 : 3.6
	5	1.410	.180	.830	
	10	2.820	.360	1.660	
	15	4.230	.540	2.490	
	20	5.640	.720	3.320	
	25	7.050	.900	4.150	
	30	8.460	1.080	4.980	
	35	9.870	1.260	5.810	
	40	11.280	1.440	6.640	
Hungarian grass..............	1	.289	.020	.188	1 : 8.4
	5	1.445	.100	.940	
	10	2.890	.200	1.880	
	15	4.335	.300	2.820	
	20	5.780	.400	3.760	
	25	7.225	.500	4.700	
	30	8.670	.600	5.640	
	35	10.115	.700	6.580	
	40	11.560	.800	7.520	
Millet.......................	1	.198	.008	.123	1 : 14.4
	5	.990	.040	.615	
	10	1.980	.080	1.230	
	15	2.970	.120	1.845	
	20	3.960	.160	2.460	
	25	4.950	.200	3.075	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
SUCCULENT ROUGHAGE—(*Cont.*)					
Millet—(*Continued*)	30	5.940	.240	3.690	
	35	6.930	.280	4.305	
	40	7.920	.320	4.920	
Green sorghum	1	.206	.006	.129	1 : 20.5
	5	1.030	.030	.645	
	10	2.060	.060	1.290	
	15	3.090	.090	1.935	
	20	4.120	.120	2.580	
	25	5.150	.150	3.225	
	30	6.180	.180	3.870	
	35	7.210	.210	4.515	
	40	8.240	.240	5.160	
Potatoes	1	.209	.011	.170	1 : 14.5
	5	1.045	.055	.850	
	10	2.090	.110	1.700	
	15	3.135	.165	2.550	
	20	4.180	.220	3.400	
	25	5.225	.275	4.250	
	30	6.270	.330	5.100	
Mangel beets	1	.091	.010	.070	1 : 6.0
	5	.455	.050	.350	
	10	.910	.100	.700	
	15	1.365	.150	1.050	
	20	1.820	.200	1.400	
	25	2.275	.250	1.750	
	30	2.730	.300	2.100	
Sugar beets	1	.135	.013	.113	1 : 7.7
	5	.675	.065	.565	
	10	1.350	.130	1.130	
	15	2.025	.195	1.695	
	20	2.700	.260	2.260	
	25	3.375	.325	2.825	
	30	4.050	.390	3.390	
Carrots	1	.114	.008	.092	1 : 10.5
	5	.570	.040	.460	
	10	1.140	.080	.920	
	15	1.710	.120	1.380	
	20	2.280	.160	1.840	
	25	2.850	.200	2.300	
	30	3.420	.240	2.760	
Flat turnips	1	.099	.009	.075	1 : 7.3
	5	.495	.045	.375	
	10	.990	.090	.750	
	15	1.485	.135	1.125	
	20	1.980	.180	1.500	
	25	2.475	.225	1.875	
	30	2.970	.270	2.250	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
SUCCULENT ROUGHAGE—(*Cont.*)					
Rutabagas	1	.114	.010	.096	1 : 8.6
	5	.570	.050	.480	
	10	1.140	.100	.960	
	15	1.710	.150	1.440	
	20	2.280	.200	1.920	
	25	2.850	.250	2.400	
	30	3.420	.300	2.880	
Cabbages	1	.100	.023	.084	1 : 2.7
	5	.500	.115	.420	
	10	1.000	.230	.840	
	15	1.500	.345	1.260	
	20	2.000	.460	1.680	
	25	2.500	.575	2.100	
	30	3.000	.690	2.520	
Pumpkins	1	.091	.010	.073	1 : 6.3
	5	.455	.050	.365	
	10	.910	.100	.730	
	15	1.365	.150	1.095	
	20	1.820	.200	1.460	
	25	2.275	.250	1.825	
	30	2.730	.300	2.190	
Apples	1	.193	.005	.175	1 : 34.0
	5	.965	.025	.875	
	10	1.930	.050	1.750	
	15	2.895	.075	2.625	
	20	3.860	.100	3.500	
	25	4.825	.125	4.375	
	30	5.790	.150	5.250	
Apple pomace	1	.170	.006	.133	1 : 21.2
	5	.850	.030	.665	
	10	1.700	.060	1.330	
	15	2.550	.090	1.995	
	20	3.400	.120	2.660	
	25	4.250	.150	3.325	
	30	5.100	.180	3.990	
Corn silage	1	.264	.014	.172	1 : 11.3
	5	1.320	.070	.860	
	10	2.640	.140	1.720	
	15	3.960	.210	2.580	
	20	5.280	.280	3.440	
	25	6.600	.350	4.300	
	30	7.920	.420	5.160	
	35	9.240	.490	6.020	
	40	10.560	.560	6.880	
	45	11.880	.630	7.740	
	50	13.200	.700	8.600	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
SUCCULENT ROUGHAGE—(*Concl'd*)					
Pea-vine silage	1	.232	.021	.170	1 : 7.1
	5	1.160	.105	.850	
	10	2.320	.210	1.700	
	15	3.480	.315	2.550	
	20	4.640	.420	3.400	
	25	5.800	.525	4.250	
	30	6.960	.630	5.100	
	35	8.120	.735	5.950	
	40	9.280	.840	6.800	
DRIED ROUGHAGE					
Timothy hay	1	.868	.028	.481	1 : 16.2
	4	3.472	.112	1.924	
	6	5.208	.168	2.886	
	8	6.944	.224	3.848	
	10	8.680	.280	4.810	
	12	10.416	.336	5.772	
	14	12.152	.392	6.734	
	16	13.888	.448	7.696	
	18	15.624	.504	8.658	
	20	17.360	.560	9.620	
Red clover hay	1	.847	.071	.490	1 : 5.9
	4	3.388	.284	1.960	
	6	5.082	.426	2.940	
	8	6.776	.568	3.920	
	10	8.470	.710	4.900	
	12	10.164	.852	5.880	
	14	11.858	.994	6.860	
	16	13.552	1.136	7.840	
	18	15.246	1.278	8.820	
	20	16.940	1.420	9.800	
Alfalfa hay	1	.918	.105	.530	1 : 4.0
	4	3.672	.420	2.120	
	6	5.508	.630	3.180	
	8	7.344	.840	4.240	
	10	9.180	1.050	5.300	
	12	11.016	1.260	6.360	
	14	12.852	1.470	7.420	
	16	14.688	1.680	8.480	
	18	16.524	1.890	9.540	
	20	18.360	2.100	10.600	
Mixed grasses and clover	1	.871	.058	.505	1 : 7.7
	4	3.484	.232	2.020	
	6	5.226	.348	3.030	
	8	6.968	.464	4.040	
	10	8.710	.580	5.050	
	12	10.452	.696	6.060	
	14	12.194	.812	7.070	
	16	13.936	.928	8.080	
	18	15.678	1.044	9.090	
	20	17.420	1.160	10.100	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
DRIED ROUGHAGE—(*Continued*)					
Hungarian hay	1	.923	.045	.590	1 : 12.1
	4	3.692	.180	2.360	
	6	5.538	.270	3.540	
	8	7.384	.360	4.720	
	10	9.230	.450	5.900	
	12	11.076	.540	7.080	
	14	12.922	.630	8.260	
	16	14.768	.720	9.440	
Millet hay	1	.840	.020	.459	1 : 22.0
	4	3.360	.080	1.836	
	6	5.040	.120	2.754	
	8	6.720	.160	3.672	
	10	8.400	.200	4.590	
	12	10.080	.240	5.508	
	14	11.760	.280	6.426	
	16	13.440	.320	7.344	
Corn fodder	1	.578	.025	.398	1 : 14.9
	5	2.890	.125	1.990	
	8	4.624	.200	3.184	
	12	6.936	.300	4.776	
	15	8.670	.375	5.970	
	18	10.404	.450	7.164	
	20	11.560	.500	7.960	
Corn stover	1	.595	.014	.342	1 : 23.4
	5	2.975	.070	1.710	
	8	4.760	.112	2.736	
	12	7.140	.168	4.104	
	15	8.925	.210	5.130	
	18	10.710	.252	6.156	
	20	11.900	.280	6.840	
Dried sorghum	1	.889	.027	.457	1 : 15.9
	4	3.556	.108	1.828	
	6	5.334	.162	2.742	
	8	7.112	.216	3.656	
	10	8.890	.270	4.570	
	12	10.668	.324	5.484	
	14	12.446	.378	6.398	
	16	14.224	.432	7.312	
	18	16.002	.486	8.226	
	20	17.780	.540	9.140	
Oat straw	1	.908	.013	.426	1 : 31.8
	3	2.724	.039	1.278	
	5	4.540	.065	2.130	
	8	7.264	.104	3.408	
	12	10.896	.156	5.112	
	15	13.620	.195	6.390	
	18	16.344	.234	7.668	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
DRIED ROUGHAGE—(*Concluded*)					
Wheat straw	1	.904	.008	.369	1 : 45.1
	3	2.712	.024	1.107	
	5	4.520	.040	1.845	
	8	7.232	.064	2.952	
	12	10.848	.096	4.428	
	15	13.560	.120	5.535	
	18	16.272	.144	6.642	
Pea-vine straw	1	.929	.059	.536	1 : 8.1
	3	2.787	.177	1.608	
	5	4.645	.295	2.680	
	8	7.432	.472	4.288	
	12	11.148	.708	6.432	
	15	13.935	.885	8.040	
	18	16.722	1.062	9.648	
Bean straw	1	.911	.040	.501	1 : 11.5
	3	2.733	.120	1.503	
	5	4.555	.200	2.505	
	8	7.288	.320	4.008	
	12	10.932	.480	6.012	
	15	13.665	.600	7.515	
	18	16.398	.720	9.018	
CONCENTRATES					
Corn (dent)	1	.894	.078	.843	1 : 9.8
	2	1.788	.156	1.686	
	3	2.682	.234	2.529	
	4	3.576	.312	3.372	
	5	4.470	.390	4.215	
	6	5.364	.468	5.058	
	7	6.258	.546	5.901	
	8	7.152	.624	6.744	
	9	8.046	.702	7.587	
Corn and cob meal	1	.849	.044	.709	1 : 15.1
	2	1.698	.088	1.418	
	3	2.547	.132	2.127	
	4	3.396	.176	2.836	
	5	4.245	.220	3.545	
	6	5.094	.264	4.254	
	7	5.943	.308	4.963	
	8	6.792	.352	5.672	
	9	7.641	.396	6.381	
Hominy chop	1	.904	.068	.840	1 : 11.4
	2	1.808	.136	1.680	
	3	2.712	.204	2.520	
	4	3.616	.272	3.360	
	5	4.520	.340	4.200	
	6	5.424	.408	5.040	
	7	6.328	.476	5.880	
	8	7.232	.544	6.720	
	9	8.136	.612	7.560	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
CONCENTRATES—(*Continued*)					
Gluten feed	1	.908	.213	.806	1 : 2.8
	2	1.816	.426	1.612	
	3	2.724	.639	2.418	
	4	3.632	.852	3.224	
	5	4.540	1.065	4.030	
	6	5.448	1.278	4.836	
	7	6.356	1.491	5.642	
	8	7.264	1.704	6.448	
	9	8.172	1.917	7.254	
Distillers' dried grains	1	.924	.228	.886	1 : 2.9
	2	1.848	.456	1.772	
	3	2.772	.684	2.658	
	4	3.696	.912	3.544	
	5	4.620	1.140	4.430	
	6	5.544	1.368	5.316	
	7	6.468	1.596	6.202	
	8	7.392	1.824	7.088	
	9	8.316	2.052	7.974	
Oats	1	.896	.088	.675	1 : 6.7
	2	1.792	.176	1.350	
	3	2.688	.264	2.025	
	4	3.584	.352	2.700	
	5	4.480	.440	3.375	
	6	5.376	.528	4.050	
	7	6.272	.616	4.725	
	8	7.168	.704	5.400	
	9	8.064	.792	6.075	
Wheat	1	.895	.100	.798	1 : 7.0
	2	1.790	.200	1.596	
	3	2.685	.300	2.394	
	4	3.580	.400	3.192	
	5	4.475	.500	3.990	
	6	5.370	.600	4.788	
	7	6.265	.700	5.586	
	8	7.160	.800	6.384	
	9	8.055	.900	7.182	
Wheat bran	1	.881	.119	.595	1 : 4.0
	2	1.762	.238	1.190	
	3	2.643	.357	1.785	
	4	3.524	.476	2.380	
	5	4.405	.595	2.975	
	6	5.286	.714	3.570	
	7	6.167	.833	4.165	
	8	7.048	.952	4.760	
	9	7.929	1.071	5.355	
Wheat middlings	1	.900	.169	.797	1 : 3.7
	2	1.800	.338	1.594	
	3	2.700	.507	2.391	
	4	3.600	.676	3.188	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
CONCENTRATES—(*Continued*)					
Wheat middlings—(*Continued*)	5	4.500	.845	3.985	
	6	5.400	1.014	4.782	
	7	6.300	1.183	5.579	
	8	7.200	1.352	6.376	
	9	8.100	1.521	7.173	
Red-dog flour	1	.915	.162	.809	1 : 4.0
	2	1.830	.324	1.618	
	3	2.745	.486	2.427	
	4	3.660	.648	3.236	
	5	4.575	.810	4.045	
	6	5.490	.972	4.854	
	7	6.405	1.134	5.663	
	8	7.320	1.296	6.472	
	9	8.235	1.458	7.281	
Barley	1	.892	.084	.773	1 : 8.2
	2	1.784	.168	1.546	
	3	2.676	.252	2.319	
	4	3.568	.336	3.092	
	5	4.460	.420	3.865	
	6	5.352	.504	4.638	
	7	6.244	.588	5.411	
	8	7.136	.672	6.184	
	9	8.028	.756	6.957	
Malt sprouts	1	.905	.203	.695	1 : 2.4
	2	1.810	.406	1.390	
	3	2.715	.609	2.085	
	4	3.620	.812	2.780	
	5	4.525	1.015	3.475	
	6	5.430	1.218	4.170	
	7	6.335	1.421	4.865	
	8	7.240	1.624	5.560	
	9	8.145	1.827	6.255	
Brewers' wet grains	1	.243	.039	.164	1 : 3.2
	5	1.215	.195	.820	
	10	2.430	.390	1.640	
	15	3.645	.585	2.460	
	20	4.860	.780	3.280	
	25	6.075	.975	4.100	
	30	7.290	1.170	4.920	
	35	8.505	1.365	5.740	
Brewers' dried grains	1	.913	.200	.657	1 : 2.3
	2	1.826	.400	1.314	
	3	2.739	.600	1.971	
	4	3.652	.800	2.628	
	5	4.565	1.000	3.285	
	6	5.478	1.200	3.942	
	7	6.391	1.400	4.599	
	8	7.304	1.600	5.256	
	9	8.217	1.800	5.913	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
CONCENTRATES—(*Continued*)					
Rye	1	.913	.095	.815	1 : 7.6
	2	1.826	.190	1.630	
	3	2.739	.285	2.445	
	4	3.652	.380	3.260	
	5	4.565	.475	4.075	
	6	5.478	.570	4.890	
	7	6.391	.665	5.705	
	8	7.304	.760	6.520	
	9	8.217	.855	7.335	
Rye bran	1	.882	.112	.621	1 : 4.5
	2	1.764	.224	1.242	
	3	2.646	.336	1.863	
	4	3.528	.448	2.484	
	5	4.410	.560	3.105	
	6	5.292	.672	3.726	
	7	6.174	.784	4.347	
	8	7.056	.896	4.968	
	9	7.938	1.008	5.589	
Buckwheat	1	.866	.081	.617	1 : 6.6
	2	1.732	.162	1.234	
	3	2.598	.243	1.851	
	4	3.464	.324	2.468	
	5	4.330	.405	3.085	
	6	5.196	.486	3.702	
	7	6.062	.567	4.319	
	8	6.928	.648	4.936	
	9	7.794	.729	5.553	
Buckwheat bran	1	.918	.059	.444	1 : 6.5
	2	1.836	.118	.888	
	3	2.754	.177	1.332	
	4	3.672	.236	1.776	
	5	4.590	.295	2.220	
	6	5.508	.354	2.664	
	7	6.426	.413	3.108	
	8	7.344	.472	3.552	
	9	8.262	.531	3.996	
Buckwheat middlings	1	.872	.227	.739	1 : 2.3
	2	1.744	.454	1.478	
	3	2.616	.681	2.217	
	4	3.488	.908	2.956	
	5	4.360	1.135	3.695	
	6	5.232	1.362	4.434	
	7	6.104	1.589	5.173	
	8	6.976	1.816	5.912	
	9	7.848	2.043	6.651	
Culled beans	1	.859	.226	.759	1 : 2.4
	2	1.718	.452	1.518	
	3	2.577	.678	2.277	
	4	3.436	.904	3.036	

TABLE 3 — (*Continued*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
CONCENTRATES—(*Continued*)					
Culled beans—(*Continued*)	5	4.295	1.130	3.795	
	6	5.154	1.356	4.554	
	7	6.013	1.582	5.313	
	8	6.872	1.808	6.072	
	9	7.731	2.034	6.831	
Canada field peas	1	.850	.197	.699	1 : 2.5
	2	1.700	.394	1.398	
	3	2.550	.591	2.097	
	4	3.400	.788	2.796	
	5	4.250	.985	3.495	
	6	5.100	1.182	4.194	
	7	5.950	1.379	4.893	
	8	6.800	1.576	5.592	
	9	7.650	1.773	6.291	
Cottonseed meal	1	.930	.376	.806	1 : 1.1
	2	1.860	.752	1.612	
	3	2.790	1.128	2.418	
	4	3.720	1.504	3.224	
	5	4.650	1.880	4.030	
	6	5.580	2.256	4.836	
	7	6.510	2.632	5.642	
	8	7.440	3.008	6.448	
	9	8.370	3.384	7.254	
Linseed oil meal	1	.902	.302	.777	1 : 1.6
	2	1.804	.604	1.554	
	3	2.706	.906	2.331	
	4	3.608	1.208	3.108	
	5	4.510	1.510	3.885	
	6	5.412	1.812	4.662	
	7	6.314	2.114	5.439	
	8	7.216	2.416	6.216	
	9	8.118	2.718	6.993	
Wet beet pulp	1	.102	.005	.082	1 : 15.4
	5	.510	.025	.410	
	10	1.020	.050	.820	
	15	1.530	.075	1.230	
	20	2.040	.100	1.640	
	25	2.550	.125	2.050	
	30	3.060	.150	2.460	
	35	3.570	.175	2.870	
	40	4.080	.200	3.280	
Dried beet pulp	1	.916	.041	.690	1 : 15.8
	2	1.832	.082	1.380	
	3	2.748	.123	2.070	
	4	3.664	.164	2.760	
	5	4.580	.205	3.450	
	6	5.496	.246	4.140	
	7	6.412	.287	4.830	
	8	7.328	.328	5.520	
	9	8.244	.369	6.210	

TABLE 3 — (*Concluded*)

Kind of food	Pounds of food	Dry matter (pounds)	Digestible protein (pounds)	Total nutriment [Dig. pro. + dig. fiber + dig. N.F.E. + (dig. fat × 2¼)] (pounds)	Nutritive ratio
CONCENTRATES—(*Concluded*)					
Sugar molasses................	1	.741	.014	.606	1 : 42.3
	2	1.482	.028	1.212	
	3	2.223	.042	1.818	
	4	2.964	.056	2.424	
	5	3.705	.070	3.030	
	6	4.446	.084	3.636	
	7	5.187	.098	4.242	
	8	5.928	.112	4.848	
	9	6.669	.126	5.454	
Skimmed milk................	1	.094	.029	.089	1 : 2.1
	4	.376	.116	.356	
	6	.564	.174	.534	
	8	.752	.232	.712	
	10	.940	.290	.890	
	12	1.128	.348	1.068	
	14	1.316	.406	1.246	
	16	1.504	.464	1.424	
	18	1.692	.522	1.602	
	20	1.880	.580	1.780	
	22	2.068	.638	1.958	
	24	2.256	.696	2.136	
Buttermilk..................	1	.098	.038	.100	1 : 1.6
	3	.294	.114	.300	
	5	.490	.190	.500	
	8	.784	.304	.800	
	10	.980	.380	1.000	
	12	1.176	.456	1.200	
	15	1.470	.570	1.500	
	18	1.764	.684	1.800	
	20	1.960	.760	2.000	
	25	2.450	.950	2.500	
	30	2.940	1.140	3.000	

The requirements are as worked out on page 1578. Then, instead of the work on page 1579, the ration may be written down directly from Table 3 as follows:

Foods	Dry matter	Digestible protein	Total nutriment
10 lbs. red clover hay..........................	8.47	.710	4.900
30 lbs. corn silage..........................	7.92	.420	5.160
5 lbs. corn and cob meal..........................	4.25	.220	3.545
4 lbs. gluten feed..........................	3.63	.852	3.224
1 lb. cottonseed meal..........................	.93	.376	.806
Total..........................	25.20	2.578	17.635

The total nutriment, 17.635 pounds, is slightly different here from that on page 1579, because in computing Table 3 from Table 1 the fourth decimal place was dropped, while in calculating the ration on page 1579 it is retained. When the shorter method is used, rations may be calculated very rapidly. The nutritive ratio of the ration is calculated as in the first method, on page 1579.

The above ration meets the factors which, it has been said, must be considered. Other illustrative rations follow, in order to show the shorter method for computing rations for all classes of stock.

Other illustrative rations

A ration for a horse weighing 1,000 *pounds, doing medium work.*— The requirements for a horse doing medium work are about 24 pounds of dry matter, which shall contain 2 pounds of digestible protein and 14.4 pounds of total nutriment, with a nutritive ratio of 1:6.2 (Table 2, page 1575). A ration that will meet the above requirements may be computed from Table 3. It is assumed that oats, corn, and timothy hay are the most available foods. The ration then is:

Foods	Dry matter	Digestible protein	Total nutriment
12 lbs. timothy hay	10.416	.336	5.772
8 lbs. oats	7.168	.704	5.400
4 lbs. corn	3.576	.312	3.372
Total	21.160	1.352	14.544

$$14.544 - 1.352 = 13.192$$
$$13.192 \div 1.352 = 9.8$$

Therefore the nutritive ratio is 1:9.8. It will be noticed that the above ration is low in dry matter and protein, and therefore wider in nutritive ratio than is called for by the standard. This will serve to illustrate that in some cases the standard is probably too high. All men who have had experience in feeding farm work-horses know that the ration suggested above will yield satisfactory results. The standards given in Table 2 are submitted only as guides and they serve a useful purpose in this respect; but rations must be carefully tried by feeding, after having been computed. All rations, however carefully they may have been computed on paper, will be changed somewhat in actual practice.

Beef cattle ration.— A ration is desired for a 1,000-pound steer during the middle of the fattening period. The requirements are 30 pounds of

dry matter, in which there are 3 pounds of digestible protein and 19.1 pounds of total nutriment, with a nutritive ratio of 1:5.4. The following ration is suggested:

Foods	Dry matter	Digestible protein	Total nutriment
10 lbs. red clover hay	8.470	.710	4.900
40 lbs. corn silage	10.560	.560	6.880
4 lbs. corn and cob meal	3.396	.176	2.836
3 lbs. oats	2.688	.264	2.025
6 lbs. gluten feed	5.448	1.278	4.836
Total	30.562	2.988	21.477

$21.477 - 2.988 = 18.489$

$18.489 \div 2.988 = 6.2$

Therefore the nutritive ratio of the above ration is 1:6.2. The above ration is somewhat wider than is called for by the standard, but it would meet with good results in practice. A deviation from the standard as great as this ration shows is permissible, provided sufficient nutriment be furnished.

A ration for fattening swine, in the middle of the fattening period.— It will be assumed that hogs weigh 125 pounds each when they are about half fattened for market. It would then take eight of them to weigh 1,000 pounds live weight. The requirements are 32 pounds of dry matter, to contain 4 pounds of digestible protein and 29.1 pounds of total nutriment, the nutritive ratio to be 1:6.3. The following ration is an example for eight hogs of the above weight for one day:

Food	Dry matter	Digestible protein	Total nutriment
20 lbs. corn	17.880	1.560	16.860
16 lbs. wheat middlings	14.400	2.704	12.752
Total	32.280	4.264	29.612

$29.612 - 4.264 = 25.348$

$25.348 \div 4.264 = 5.9$

Therefore the nutritive ratio of the above ration is 1:5.9. In calculating the dry matter, protein, and total nutriment in 20 pounds of corn from Table 3, the amounts in 1 pound are multiplied by 20. In like manner, in calculating the dry matter, protein, and total nutriment in 16 pounds of wheat middlings, the amounts in 8 pounds are multiplied by 2. This will illustrate how Table 3 may be used to advantage even when the amount of a food differs from the amounts of that food which are listed in Table 3.

Here the nutritive ratio is a little narrower than is necessary according to the standard. Whether it should be changed would depend very largely on the relative cost of corn and wheat middlings; if corn were cheaper, it would be advisable to feed 24 pounds of corn and 12 pounds of wheat middlings, which would change the nutritive ratio to about 1:6.3, as called for by the standard. It is intended, in a ration such as the above, that the wheat middlings shall be fed as a slop mixed with water. The corn would be fed whole. If skimmed milk or buttermilk were available, of course less middlings would be necessary.

A ration for a dairy cow.— A ration is desired for a dairy cow weighing 1,200 pounds and yielding 36 pounds of milk per day which tests 3.6 per cent butter fat. The requirements for this ration will be:

	Digestible protein	Total nutriment
For maintenance, 1,200 lbs. live weight	.840	9.510
For product, 36 lbs. milk testing 3.6 per cent butter fat	2.218	11.675
Total	3.058	21.185

$21.185 - 3.058 = 18.127$
$18.127 \div 3.058 = 5.9$

The nutritive ratio required is 1:5.9. It has been said that in formulating the dairy ration about two thirds of the dry matter shall be in roughage and one third shall be in grain. For dairy cows, one fifth to one third of the dry matter should be in a succulent food. There shall be not less than 24 pounds of dry matter in order to have sufficient bulk in the ration, and the nutritive ratio shall be not wider than 1:6. With these factors in mind the following ration is suggested to meet the above requirements:

Food	Dry matter	Digestible protein	Total nutriment
12 lbs. red clover hay	10.164	.852	5.880
40 lbs. corn silage	10.560	.560	6.880
4 lbs. gluten feed	3.632	.852	3.224
4 lbs. wheat bran	3.524	.476	2.380
4 lbs. hominy chop	3.616	.272	3.360
Total	31.496	3.012	21.724

$21.724 - 3.012 = 18.712$
$18.712 \div 3.012 = 6.2$

Therefore the nutritive ratio of the above ration is 1:6.2. This is a little wider than has been said was best for the greatest production. Therefore it would perhaps be best to take from the ration 1 pound of hominy chop and put in 1 pound more of gluten feed. The ration would then become:

Food	Dry matter	Digestible protein	Total nutriment
12 lbs. red clover hay	10.164	.852	5.880
40 lbs. corn silage	10.560	.560	6.880
5 lbs. gluten feed	4.540	1.065	4.030
4 lbs. wheat bran	3.524	.476	2.380
3 lbs. hominy chop	2.712	.204	2.520
Total	31.500	3.157	21.690

$$21.690 - 3.157 = 18.533$$
$$18.533 \div 3.157 = 5.9$$

The nutritive ratio is now 1:5.9. This is considered more nearly correct for the greatest production.

The illustrative rations given above will serve to show what are good rations and the manner of using Tables 2 and 3. Table 3 is merely a short method of using Table 1. With a little practice, rations may be calculated accurately and quickly in this way.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 26 | ITHACA, N. Y. OCTOBER 15, 1912 | STOCK FEEDING SERIES No. 1

COMPUTING RATIONS FOR FARM ANIMALS

DISCUSSION PAPER

A discussion paper is enclosed with each Reading-Course lesson in order to help the reader to obtain the greatest benefit from the lesson and to give an opportunity for an expression of his opinion. Questions are asked with a view of bringing out the more important points and of stimulating observation and original thought. The answering of these questions is optional, but *it is desirable that persons who wish to continue to receive Reading-Course lessons sign and return the discussion paper.* This will require two-cent postage, which is the only expense connected with the Reading-Course. Each discussion paper returned will be read over carefully and will not be quoted. Requests for information on agricultural subjects will be given a personal reply.

The discussion paper serves other purposes. New readers should indicate on it the series of Reading-Course lessons in which they are particularly interested, so that lessons already published may be sent them. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. The following series have been projected: THE SOIL, FARM CROPS, PLANT-BREEDING, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT GROWING, STOCK FEEDING. References for advanced study will be given on request. *The space below on this page is reserved for correspondence concerning reading-course work and also for names and addresses of any persons likely to be interested.*

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

1. Calculate the nutritive ratio of the ration that you feed to your milking herd. What kinds of feeds and what amount of each have you found to give the best results?

2. What feeds rich in protein do you grow on your own farm? Have you tried to raise alfalfa?

3. Have you a silo? If not, how do you furnish succulent feed to your cows in the winter?

4. Do you weigh the milk from each cow at each milking? How much attention do you pay to production in arranging your rations?

5. What is your ration for your work horses?

6. Do you feed your horses as heavily on a day when they do not work — as Sunday, for example — as on other days?

7. When do you water your horses? Are your horses troubled with colic?

8. Do you know whether your feeding operations, either for meat or for milk, actually yield you a profit?

9. Have you any animals that do not pay for their keeping? How do you know?

Name..............................

Address..............................

Date..............................

Address all correspondence to the Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, New York.

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

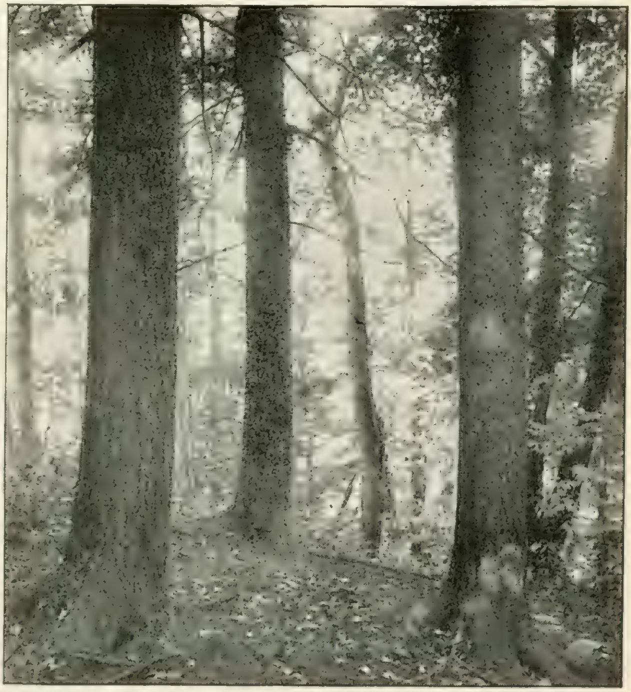
COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 28 | ITHACA, N. Y. NOVEMBER 15, 1912 | FARM FORESTRY SERIES No. 2

RECENT NEW YORK STATE LAWS GIVING RELIEF FROM TAXATION ON LANDS USED FOR FORESTRY PURPOSES

WALTER MULFORD

Several new laws relating to the taxation of forest lands in New York State went into effect in April, 1912. Complete exemption from taxation is granted in some cases, and a reduction or limitation of the tax in other cases.



In order to get relief from taxation, the land must be used for forestry purposes. It must be planted with forest trees if it is not already well wooded. If it is now covered with brush or with an unsatisfactory stand of timber, it must be underplanted, that is, good trees must be planted under the existing growth. If it is already well wooded, it must be maintained as a satisfactory forest.

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y. under the Act of Congress of July 16, 1894.

Trees needed for the planting or underplanting may be bought from the New York State Conservation Commission if desired. The Commission has large nurseries in various parts of the State, and sells trees at the cost of production to private parties who will use the trees for forest planting within the State.

The control of the regulations under which tax relief is granted is in the hands of the Conservation Commission. Applications for relief from taxation under these new laws, correspondence regarding details of the work to be done, and requests for trees to be used in planting, should be addressed to the Conservation Commission, Albany, New York.

THE NATURE OF THE TAX RELIEF

The nature of the tax relief to be granted depends on the character of the land and on the kind of care that is given to the land by the owner. For convenience, the lands on which tax relief can be obtained may be divided into four classes. These four classes are not entirely distinct from one another; that is, many lands are of such character that they could be placed in more than one class. The following table shows the character of the land in each class, what must be done in order to get relief from taxation, and the nature of the relief granted:

Character of land	What must be done in order to get relief from taxation	Nature of the relief granted
Not wooded; 1 to 100 acres	Plant with forest trees and maintain as forest	No tax on either trees or land for 35 years
Wooded or brush land; 1 to 100 acres	Underplant with forest trees and maintain as forest	No tax on trees for 35 years; land to be taxed, but the assessment for 35 years to be only 50 per cent of the assessable valuation
Assessed valuation of land not over $5 per acre; unsuitable for agricultural purposes; bare or wooded; over 5 acres	Plant or underplant with forest trees and maintain as forest	No tax on trees for 35 years; land to be taxed, but the assessed valuation to be fixed now and remain constant for 35 years, this assessed valuation not to exceed the present assessed valuation of similar lands in the vicinity
Wooded (either natural growth or planted); not over 50 acres	Manage as a permanent woodlot	No tax on trees until cut; land to be taxed, but the assessed valuation not to exceed $10 per acre; a tax of 5 per cent of stumpage value of trees when cut; these provisions to continue so long as the property is managed as a permanent woodlot

The principal points in the law dealing with each of the above classes of land are summarized below, often by means of direct quotations from the

law. The complete text of the laws is then given, for the use of those who wish further details.

RELIEF FROM TAXATION BY FOREST PLANTING

On lands not wooded, and of small area

Areas of one acre to one hundred acres of land not wooded may, after the land has been planted for forestry purposes with not less than eight hundred trees per acre, be exempted from all taxation for a period of thirty-five years. The exemption from taxes applies both to the land and to the trees growing on it. But "lands situated within twenty miles of the corporate limits of a city of the first class, or within ten miles of the corporate limits of a city of the second class, or within five miles of the corporate limits of a city of the third class, or within one mile of the corporate limits of an incorporated village" are not entitled to this exemption.

Lands that were forested before this law was passed (April 10, 1912) may also receive the benefit of the law if the planting was done since April 10, 1909, and if the application for exemption is made before April 10, 1913.

The procedure in exempting the planted area from taxation is as follows: After the planting is completed, the owner files with the Conservation Commission at Albany an affidavit proving the planting and describing the location of the land. The Conservation Commission then sends a representative to inspect the area. If the planting is found to have been properly completed, the Conservation Commission reports to the county treasurer that the land is to be exempted from taxation. The county treasurer reports in turn to the assessors of the tax district in which the land is located, who enter the land on the next assessment roll as being exempt from taxation for a period of thirty-five years.

If land thus exempted ceases to be used exclusively as a forest plantation before the period of exemption has expired, the usual taxes will again be levied against the property.

If the land continues to be used exclusively for the growth of a planted forest after the thirty-five-years period of exemption has expired, the land is to be assessed at its true value but the timber growing on the land remains exempt from taxation, with the following exception: if any timber is cut before taxes on the land have been paid for five consecutive years after the exemption period has expired, a tax of five per cent of the estimated stumpage value of the cut timber must be paid. However, this tax is not levied on trees that are cut, under the supervision of the Conservation Commission, for the purpose of thinning the forest in order to increase the rate of growth of the remaining timber.

For further details, the reader is referred to chapter 249 of the Laws of 1912 (p. 1604).

On wooded or brush lands of small area

The law dealing with relief from taxation on wooded or brush lands of small area (one to one hundred acres) is the same as described above for small areas not wooded, with the following exceptions: (1) Instead of planting at least eight hundred trees per acre, the owner is to underplant the area with at least three hundred trees per acre. (2) All trees growing on the land are exempt from taxation for thirty-five years; the land itself is to be taxed, but it is to be assessed for thirty-five years at only one half its assessable valuation.

Further details may be found in chapter 249 of the Laws of 1912 (p. 1604).

On nonagricultural lands, bare or wooded, of large or small area, assessed at not over five dollars per acre

The owner of bare or wooded land who wishes to use that land for raising a crop of timber may obtain some tax relief if the land is unsuitable for agriculture, if its assessed valuation does not exceed five dollars per acre, and if its area is at least five acres.

The relief that may be obtained in this case is that all trees growing on the land are exempt from taxation for thirty-five years; and that, although the land itself is taxed, its assessed valuation is determined at the outset and cannot then be increased for thirty-five years. In determining this assessed valuation, it cannot be placed higher than the average assessed valuation of the land for the preceding five years, or than the assessed valuation of other similar lands in the same tax district. The certainty as to the rate at which the property will be assessed for a period of thirty-five years is the distinctive feature of this law.

In order to obtain this tax relief, the owner must plant or underplant with such forest trees as the Conservation Commission may direct, and must maintain and protect the forest in accordance with the instructions of the Conservation Commission.

The procedure in getting the lands specially listed for taxation under the provisions of this law is as follows: The owner should apply to the Conservation Commission at Albany, giving a description of the land, and enclosing a certificate or sworn statement by the tax assessor as to the value of the land. A representative of the Commission then examines the property. If the area is found to be suitable, a written agreement is made between the Commission and the owner, the former agreeing to supply at cost the trees needed for planting, and the latter agreeing to do the planting and to care for the forest as directed. This agreement is recorded in the county clerk's office, and " the provisions thereof shall be deemed to be and be covenants running with the land." The owner is to do the planting within one year after making this agreement. When

the planting is completed, he files with the Commission an affidavit proving the planting. After inspection of the area to see that everything is satisfactory, the Conservation Commission reports to the county treasurer, and the county treasurer to the local tax assessor, that the area is to be taxed as described above.

"The right to such exemption and taxation shall be inviolable and irrevocable as a contract obligation of the state, so long as the owner of the land so planted shall fully comply with and perform the conditions of such contract not exceeding said period of thirty-five years." If the owner does not live up to the contract, the property may be taxed in the ordinary manner, or the Commission may by injunction restrain the owner from improper treatment of the forest.

Further details may be found in chapter 444 of the Laws of 1912 (p. 1607).

RELIEF FROM TAXATION BY CARE OF WOODLOTS

A modified form of taxation may be obtained for a woodlot, either of natural growth or planted, if its area does not exceed fifty acres and if it is not "situated within twenty miles of the corporate limits of a city of the first class, nor within ten miles of the corporate limits of a city of the second class, nor within five miles of the corporate limits of a city of the third class, nor within one mile of the corporate limits of an incorporated village."

The modified plan of taxation for such lands is as follows: (1) The trees growing on the land are exempt from taxation until they are cut. (2) The land is to be taxed, but its assessed valuation is not to exceed ten dollars per acre and is not to be greater than the assessed valuation of other similar lands in the same tax district. (3) When live trees are cut, they are subject to a tax of five per cent of their estimated stumpage value, except that trees cut for "firewood or building material for the domestic use of said owner or his tenant" are not taxed.

In order to get the benefit of this method of taxation, the law requires that the owner must maintain the woodlot in a manner to be prescribed for it by the Conservation Commission.

The first step in getting the land separately classified for taxation on this basis is for the owner to apply to the Conservation Commission, describing the land and giving such other information as the Commission may require. A representative of the Commission then inspects the woodlot, and if it is found to be suitable the Commission submits to the owner a plan of management for the woodlot. If the plan is accepted by the owner, the Conservation Commission reports to the county treasurer, and the county treasurer reports to the tax assessors of the district, that the property is to be given the special form of taxation.

The property will continue to be taxed on this basis so long as the owner maintains it as a woodlot in accordance with the instructions of the Conservation Commission. If the owner fails to so maintain the woodlot, it will again be taxed in the usual way.

For further details, the reader is referred to chapter 363 of the Laws of 1912 (p. 1606).

SUGGESTIONS

The State now guarantees reasonable taxation on certain classes of forest lands that are managed as true forest properties. The State also furnishes trees for planting at cost. It is to be hoped that the owners of lands which are not well adapted to cultivated farm crops will see their opportunity and will take advantage of this twofold help in making their forest lands more profitable.

A person owning land of such character that it is entitled to be entered for tax relief under more than one of the above described laws, may apply to have the land listed for taxation under whichever law he chooses.

This lesson is intended merely to help in calling attention to the laws, and to give a brief general outline of the working of each law. It is not a complete manual of procedure of the work to be done in taking advantage of the laws. The Conservation Commission will prescribe detailed methods of procedure and will direct the work. *The first thing to be done in all cases is for the owner to write to the Conservation Commission for full information as to the method of procedure. Possible loss of time and work will be avoided by so doing.*

FULL TEXT OF THE LAWS

New York State Laws of 1912, Chapter 249

AN ACT to amend the tax law, in relation to the exemption and reduction in assessment of lands which have been planted with trees for forestry purposes.

Became a law April 10, 1912, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Article one of chapter sixty-two of the laws of nineteen hundred and nine, entitled "An act in relation to taxation, constituting chapter sixty of the consolidated laws," is hereby amended by adding at the end a new section to be section sixteen, and to read as follows:

§ 16. **Exemption and reduction in assessment of lands planted with trees for forestry purposes.** Whenever the owner of lands, to the extent of one or more acres and not exceeding one hundred acres, shall plant the same for forestry purposes with trees to the number of not less than eight hundred to the acre, and whenever the owner of existing forest or brush lands to the extent of one or more acres and not exceeding one hundred acres, shall underplant the same with trees, to the number of not less than three hundred to the acre, and proof of that fact shall be filed with the assessors of the tax district or districts in which such lands are situated as hereinafter provided, such lands so forested shall be exempt from assessment and taxation for any purpose for a period of thirty-five

years from the date of the levying of taxes thereon immediately following such planting, and such existing forest or brush lands so underplanted shall be assessed at the rate of fifty per centum of the assessable valuation of such land exclusive of any forest growth thereon for a period of thirty-five years from the date of the levying of taxes thereon immediately following such underplanting. The owner or owners of lands forested as above provided, in order to secure the benefits of this section, shall file with the conservation commission an affidavit making the due proof of such planting or underplanting and setting forth an accurate description of such lands, the town and county in which the same are situated, the number of trees planted or underplanted to the acre and the number of acres so forested, which affidavit shall remain on file in the office of said commission. Upon the filing of such affidavit it shall be the duty of the conservation commission to cause an inspection of such forested lands to be made by a competent forester or other employee of said commission who shall make and file with said commission a written report of such inspection. If the commission is satisfied from the said affidavit and the report of inspection that the lands have been forested as above provided, in good faith and by adequate methods to produce a forest plantation, and are entitled to the exemption of assessment or to a reduction of assessment as provided in this section, it shall make and execute a certificate under the seal of its office, and file the same with the county treasurer of the county in which the lands so forested are located, which certificate shall set forth a description of the lands affected by this section, the area and owner or owners thereof, the town or towns in which the same are situated, the description upon the last assessment-roll which included said lands, the period of exemption or of reduction of assessment to which such lands are entitled and the date of the expiration of such exemption or reduction of assessment. Upon the filing of such certificate it shall be the duty of the county treasurer to file with the assessors of the tax district in which the lands described therein are located within ten days after receipt thereof a certified copy of such certificate, and the assessors of such tax district shall place the lands according to the description contained in said certificate upon the next assessment-roll prepared for the assessment of lands within such tax district, and shall exempt, or reduce the assessment upon, the lands so described as hereinbefore provided, and shall insert upon the margin of said assessment-roll opposite the description of said lands, a statement that in accordance with the provisions of this section of the tax law said lands are exempt from taxation or that the assessment thereof is reduced fifty per centum as the case may be and insert also in the margin the date of the expiration of such exemption or reduction of assessment and such lands shall continue to be exempted, assessed and carried in such manner upon the assessment-rolls of such town until the date of the expiration of such exemption or reduction of assessment. Lands which have been forested as above provided within three years prior to the taking effect of this section may come within its provisions if application therefor is made to the conservation commission within one year from the time when this section takes effect, but except as provided by this section the period of exemption or reduction as certified to by the conservation commission shall not exceed the period of thirty-five years from the date of the original planting. Lands situated within twenty miles of the corporate limits of a city of the first class, or within ten miles of the corporate limits of a city of the second class, or within five miles of the corporate limits of a city of the third class, or within one mile of the corporate limits of an incorporated village shall not be entitled to the exemption or reduction of assessment provided for by this section. In the event that lands exempted or reduced in taxation as above provided shall, by act of the owner or otherwise, at any time during the period of exemption or reduction in taxation cease to be used exclusively as a forest plantation to the extent provided by this section to entitle such land to the privileges of this section, the said exemption and reduction in taxation provided for in this section shall no longer apply and the assessors having jurisdiction are hereby empowered and directed to assess the said land at the value and in the manner provided by the tax law for the general assessment of land. If any land exempted under this section continues to be used exclusively for the growth of a planted forest after the expiration of the period of exemption provided hereby, the land shall be assessed at its true value and the timber growth thereon shall be exempt from taxation, except if such timber shall be cut before the land has been duly assessed and taxes regularly paid for five consecutive years after the exemption period has expired, such timber growth shall be subject to a tax of five per centum of the estimated stumpage value at the time of cutting, unless such cuttings are thinnings for stimulating growth and have been made under the supervision of the conservation commission. Whenever the owner shall propose to make any cutting of

such timber growth for a purpose other than for thinning as above provided, he shall give thirty days' notice to the assessors of the tax district on which the land is located, who shall forthwith assess the stumpage value of such proposed cutting, and such owner shall pay to the collector of the town in which such land is situated before cutting such timber five per centum of such assessed valuation. If such owner shall fail to give such notice and pay such taxes he shall be liable to a penalty of three times the amount of such tax, and the supervisor of the town may bring an action to recover the same for the benefit of the town in any court of competent jurisdiction.

§ 2. This act shall take effect immediately.

New York State Laws of 1912, Chapter 363

AN ACT to amend the tax law, in relation to the exemption and reduction in assessment of lands which shall be maintained as wood lots and to encourage the growth of trees for such purposes.

Became a law April 15, 1912, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Article one of chapter sixty-two of the laws of nineteen hundred and nine, entitled "An act in relation to taxation, constituting chapter sixty of the consolidated laws," is hereby amended by adding at the end a new section, to be section seventeen, and to read as follows:

§ 17. **Exemption and reduction in assessment of lands maintained as wood lots and to encourage the growth of trees for such purposes.** In order to encourage the maintenance of wood lots by private owners and the practice of forestry in the management thereof, the owner of any tract of land in the state, not exceeding fifty acres, which is occupied by a natural or planted growth of trees, or by both, which shall not be situated within twenty miles of the corporate limits of a city of the first class, nor within ten miles of the corporate limits of a city of the second class, nor within five miles of the corporate limits of a city of the third class, nor within one mile of the corporate limits of an incorporated village, may apply to the conservation commission in manner and form to be prescribed by it, to have such land separately classified for taxation. Application for such classification shall be made in duplicate and accompanied by a plot and description of the land, and such other information as the commission may require. Upon the filing of such application it shall be the duty of the commission to cause an inspection of such land to be made by a competent forester for the purpose of determining whether or not it is of a suitable character to be so classified. If the commission shall determine that such land is suitable to be so classified, it shall submit to the owner a plan for the further management of said land and trees and shall make and execute a certificate under the seal of the commission and file the same with the county treasurer of the county in which the land is located, which certificate shall set forth a description and plot of the land so classified, the area and owner thereof, the town or towns in which the same is situated, and that the land has been separately classified for taxation in accordance with the provisions of this section. Upon the filing of such certificate it shall be the duty of the county treasurer to file with the assessors of the tax district in which the land described therein is located, within ten days after receipt thereof, a certified copy of such certificate. So long as the land so classified is maintained as a wood lot, and the owner thereof faithfully complies with all the provisions of this section and the instructions of the commission, it shall be assessed at not to exceed ten dollars per acre and taxed annually on that basis. In fixing the value of said lands for assessment, the assessors shall in no case take into account the value of the trees growing thereon, and said land shall not be assessed at a value greater than other similar lands within the same tax district, which contain no forest or tree growth, are assessed. The assessors of each tax district where said land so classified is located shall insert upon the margin of said assessment and opposite the description of such land a statement that said land is assessed in accordance with the provisions of this section. In the event that land so classified as above prescribed shall at any time by act of the owner or otherwise cease, in the judgment of the commission, to be used exclusively as a wood lot to the extent provided by this section to entitle the owner of such land to the privileges

of this section, the exemption and valuation in taxation provided for in this section shall no longer apply and the assessors having jurisdiction shall, upon the direction of the commission assess the said land at the value and in the manner provided by the tax law for the general assessment of land. Whenever the owner shall propose to cut any live trees from said land, except for firewood or building material for the domestic use of said owner or his tenant, he shall give the commission at least thirty days' notice prior to the time he desires to begin cutting, who shall designate for the owner the kind and number of trees, if any, most suitable to be cut for the purpose for which they are desired, and the cutting and removal of the trees so designated shall be in accordance with the instructions of said commission. After such trees are cut and before their removal from the land, the owner shall make an accurate measurement or count of all of the trees cut and file with the assessors of the tax district a verified, true and accurate return of such measurement or count and of the variety and value of the trees so cut. The assessors shall forthwith assess the stumpage value of the timber so cut, and such owner shall pay to the tax collector of the town in which such land is situated, before the removal of any such timber, five per centum of such valuation. If such owner shall fail to give such notices and pay such taxes he shall be liable to a penalty of three times the amount of such tax, and the supervisor of the town may bring an action to recover the same for the benefit of the town in any court of competent jurisdiction.

§ 2. This act shall take effect immediately.

New York State Laws of 1912, Section 89 of Article 5 of Chapter 444

AN ACT to amend the conservation law generally, and in relation to lands, forests and public parks.

Became a law April 16, 1912, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

§ 89. **Exemption of reforested lands from taxation.** In consideration of the public benefit to be derived from the planting and growing of forest trees, and to the end that the growth of forest trees may be encouraged and the water supply of the state protected and conserved, and that floods may be prevented, the owner of any waste, denuded or wild forest lands, of the area of five acres or upwards, within the state, which are unsuitable for agricultural purposes, who shall agree with the commission to set apart for reforestation or for forest tree culture, the whole, or any specific portion of such waste, denuded or wild forest lands, of the area of five acres or upwards, may apply to the conservation commission, in manner and form to be prescribed by it, to have such lands separately classified as lands suitable for reforestation or underplanting within the purposes and provisions of this section. Each application for such classification shall be accompanied by a plot and description of the land, and shall state the area, character and location thereof, and such other information in reference thereto as the commission may require; such application shall be accompanied by a certificate of the assessors of the tax district or districts in which said lands are located, which shall set forth the assessed valuation of said lands for the last five years preceding the date of such application; or if said lands have not been separately assessed during any part of said period, or the timber has been removed therefrom at any time during said period of five years, by a sworn statement of the assessors of the value of said lands, which lands shall be valued at the same rate as other waste, denuded or wild forest lands in said tax district, similarly situated; such application shall also contain a declaration that the owner intends to reforest or underplant the lands described in such application with such number and kind of trees per acre and in such manner as the commission shall specify, and to comply with all reasonable rules and regulations of the commission in reference to future care and management of said lands and trees.

If it appears from said application and certificate or sworn statement that said lands are suitable for reforestation or underplanting purposes and have not been assessed during the period of five years next preceding the date of such application at an average

valuation of more than five dollars per acre, or that similar lands in said vicinity have not been assessed for more than five dollars per acre, the said commission shall, as soon as practicable after the receipt of such application, cause an examination to be made of the lands for the purpose of determining whether or not it is of a character suitable to be reforested or underplanted and to be classified as such. After such examination if the commission shall determine that such lands are suitable for reforestation or underplanting, it is hereby empowered to enter into a written agreement with the owner, which agreement shall be to the effect that the commission will furnish said owner, at a price not to exceed cost of production, trees to be set out upon said lands, the kind and number to be prescribed by the commission, and to be set forth in said agreement; that the owner will set out upon said land the number and kind of trees per acre designated by the commission; and that said land will not be used for any purpose other than forestry purposes, during the period of exemption, without the consent of the commission; and that said lands and the trees thereon will be managed and protected at all times during the period of said exemption in accordance with the directions and instructions of the commission. Said agreement shall be recorded in the office of the county clerk of the county where the lands are situated, and the provisions thereof shall be deemed to be and be covenants running with the land. Within one year after the making of such agreement, said lands shall be planted by the owner with the number and kind of trees specified therein; and the owner shall file with the commission an affidavit making due proof of such planting, which affidavit shall remain on file in the office of said commission. Upon the filing of such affidavit the commission shall cause an inspection of such lands to be made by a competent forester who shall make and file with said commission a written report of such inspection. If the commission is satisfied from said affidavit and report that the lands have been forested in good faith as provided in said agreement, it shall make and execute a certificate under its seal, and file the same with the county treasurer of the county in which the lands or any part thereof so forested are located, which certificate shall set forth a description of said lands, the area and the owner thereof, the town in which the same are situated, a statement that the land has been separately classified for taxation in accordance with the provisions of this section and a valuation, in excess of which, said lands shall not be assessed for the period of thirty-five years, which valuation shall not in any event be greater than the average valuation at which the same lands were assessed for the last five years preceding the date of said application, or the value of such lands as appears by the aforesaid sworn statements of the assessors of such tax district, and a statement that the trees and timber thereon shall be exempt from taxation during said period. Upon the filing of such certificate it shall be the duty of the county treasurer to file with the assessors of each tax district in which the lands described are located, a certified copy thereof, and the assessors of such tax district shall place the lands according to the description contained in said certificate upon the next assessment-roll, prepared for the assessment of lands within such tax district, at a valuation not to exceed the amount stated in said certificate, and not to exceed the assessed valuation of similar lands in said tax district; and said assessors shall insert upon the margin of said assessment-roll opposite the description of said lands, a statement that said lands shall not be assessed during the period of thirty-five years at a value in excess of said amount and that the trees and timber growing upon said lands shall be wholly exempted from taxation during said period; and said assessors shall also insert upon the margin of said assessment-roll the date of expiration of said exemption. Such lands shall be assessed, and continue to be assessed, and carried in such manner, upon the assessment-rolls, of such towns until the end of the exemption period. In the event that lands so classified shall, in the judgment of the commission, cease to be used exclusively for forestry purposes to the extent provided in the agreement between the conservation commission and the owner, or that said owner has violated its terms, or any reasonable rules and regulations of the commission in respect to the use of or the cutting of timber on said lands, the exemption from taxation provided in this section shall no longer apply; or at the election of the commission such owner may be also restrained from said acts by injunction; and the assessors having jurisdiction shall, upon the direction of the commission, assess said lands against the owner at the value, and in the manner provided by the tax law for general assessment of land.

The planting or underplanting of a tract in forest trees in compliance with the agreement as provided in this section shall be taken and deemed to be an acceptance by the owner of the exemption privileges herein granted and of the conditions herein imposed; and in consideration of the public benefit to be derived from the planting, underplanting,

cultivation and growth of such trees the exemption of such trees from taxation and the taxation of the land upon which such trees are grown as herein provided, shall be continued and is hereby assured; and the right to such exemption and taxation shall be inviolable and irrevocable as a contract obligation of the state, so long as the owner of the land so planted shall fully comply with and perform the conditions of such contract not exceeding said period of thirty-five years.

THE CORNELL READING-COURSES

Since October, 1911, a publication known as "The Cornell Reading-Courses" has been issued by the College. This is an enlargement and revision of the Reading-Course for Farmers and the Reading-Course for Farmers' Wives, which have been published by the College for ten years. The Cornell Reading-Courses are two in number — The Reading-Course for the Farm and The Reading-Course for the Farm Home. These are not correspondence courses in the ordinary sense, but means of interesting readers in the elementary agricultural subjects and important farm, household, and general rural problems. They also aim to lead the reader to express his own mind on the different subjects and to discuss his own experience. Such persons as desire may receive suggestions for advanced reading. The lessons for the farm are issued on the fifteenth of each month and are numbered by even numbers. The lessons for the farm home are numbered by odd numbers and issued the first of each month. The Cornell Reading-Courses are free to residents of New York State.

CORNELL STUDY CLUBS

The late fall of the year is the time to lay plans for spending one's leisure during the winter months to the best advantage. A large number of inquiries are received concerning the farm publications of the College of Agriculture and it is evident that many persons desire to undertake reading that will help them conduct their farming operations to better advantage. When such reading can be done in a group there is an added interest and a better opportunity for self-expression, resulting often in mutual helpfulness between members of the group. The group may include men, women, and young people and may have social features as a part of the programs for the meetings.

Reading matter which is particularly adapted to such groups is found in the two Cornell Reading-Courses — the course for the farm and the course for the farm home. If the group is composed of both men and women, the lessons in the two courses may be alternated, or two separate groups may be formed holding part of the program in common. Granges, churches, and other organizations have undertaken the formation of such groups or conducted such work in connection with regular meetings. In communities where organizations are not attempting to take up agri-

cultural study, Cornell study clubs are particularly helpful. The supervisors of the Cornell Reading-Courses will cooperate with interested persons in any locality in the State in the formation of study clubs. Suggestions will be offered for preparing programs. Correspondence is invited.

THE CORNELL READING-COURSE FOR THE FARM

The Cornell Reading-Course for the Farm, as stated above, is an enlargement and revision of the former Reading-Course for Farmers. Following is a list of available back numbers of the former Reading-Course for Farmers (designated as " Old course ") and lessons of the present course (designated as " New course "), arranged by series:

Series		*Lessons*	
The soil	Old course	37	Drainage and larger crops
	New course	2	The soil: Its use and abuse
Poultry	New course	4	Incubation.— Part I
		6	Incubation.— Part II
		10	Feeding young chickens
Rural engineering	New course	8	Knots, hitches, and splices
Farm forestry	New course	12	The improvement of the woodlot
		28	Recent New York State laws giving relief from taxation on lands used for forestry purposes
The horse	New course	14	Horse breeding to increase the farm income
Dairying	Old course	23	Construction of sanitary dairy stables
	New course	16	Practical dairy problems
Fruit growing	New course	18	The renewal of the neglected orchard
		22	The culture of the currant and the gooseberry
Farm crops	Old course	10	Pastures and meadows
	New course	20	Alfalfa for New York
		24	The rotation of farm crops
Stock feeding	Old course	7	The computing of balanced rations
	New course	26	Computing rations for farm animals
Plant-breeding	Old course	41	Improving plants by selection or breeding
		42	Improving corn by seed selection

Residents of New York State may register for one or more of the series named above by addressing the Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, New York.

The foregoing list is correct to November 15, 1912. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 28 | ITHACA, N. Y. NOVEMBER 15, 1912 | FARM FORESTRY SERIES No. 2

RECENT NEW YORK STATE LAWS GIVING RELIEF FROM TAXATION ON LANDS USED FOR FORESTRY PURPOSES

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. The answering of the questions is optional, but a majority of readers accept this opportunity for additional work. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT GROWING, FARM CROPS, STOCK FEEDING, PLANT-BREEDING. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to continue to receive Reading-Course lessons should sign and return the discussion paper sent with each lesson.* Each discussion paper returned will be read over carefully and a personal reply will be made when help can be given. The Reading-Course will endeavor to aid in the solution of farm problems, assist in the organization of reading-course clubs, and give references for advanced study. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.*

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

1. Except for the laws described in this lesson, do you consider the present methods of taxing woodlands to be unjust? If so, in what ways are they unjust?

2. What is your opinion of the laws described in this lesson?

3. Do the assessors in your town usually value the woodlot separately from the other land on the farm, when making up the total assessed valuation of the farm?

4. If so, at what percentage of its true value do they assess the woodlot?

5. Is woodland assessed upon the value of the standing timber, or upon the value of the land for other purposes when cleared, or upon both?

6. What is the usual assessed value per acre of cut-over land and of brush land in your town?

7. What is the usual assessed value per acre of land containing merchantable timber in your town?

8. Do you expect to plant land with forest trees under the provisions of the new tax laws described in this lesson?

9. Do you expect to manage your woodlands under state advice and obtain the benefits of the new tax laws?

Name..............................

Address..............................

Date........................

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL II. No. 30 | ITHACA, N. Y. DECEMBER 15, 1912 | VEGETABLE-GARDENING SERIES No. 1

HOTBED CONSTRUCTION AND MANAGEMENT

A. E. WILKINSON

The advantages of a good hotbed, to both the home and the commercial vegetable grower, have many times been strongly emphasized. In making garden plans it seems almost imperative to consider hotbeds, unless a larger forcing outfit, such as a greenhouse, is to be built. Among

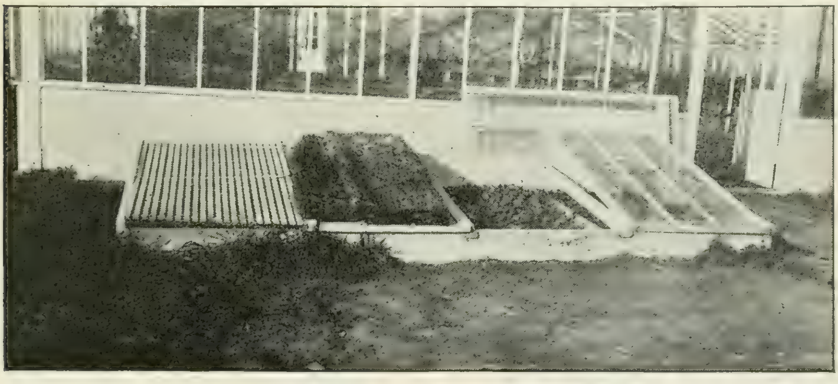


FIG. 5.—*A four-sash hotbed. Notice the slat frame for shading, the straw mat for protection, the open bed with vegetables, and the ventilating sash*

the advantages that a properly managed hotbed gives to the home garden, the following may be mentioned:

1. It is possible by this means to start plants much earlier than they could be started under natural conditions, and by transplanting these to the garden an advance growth of four to six weeks may be gained over seeds sown in the ground.

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2. Crops may be entirely matured in hotbeds before their natural season. For example, corn or beans may thus be grown to maturity, the edible parts ripening long before their regular time.

*FIG. 6.—*Two-sash hotbed pit ready for the manure*

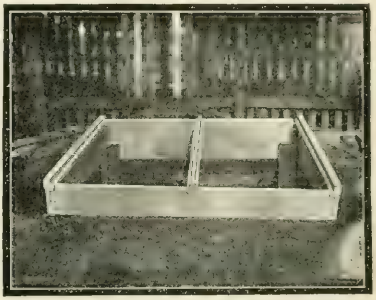

FIG. 7.—*Top frame similar to a cold frame, which is placed over the pit shown in Fig. 6*

3. A vegetable may be grown to maturity in a climate that is too short for its full development under natural conditions. The growing of egg-plants is a good example of this, especially in those zones where one hundred and twenty days, or fewer, constitute the crop-growing season.

4. Through the first three advantages named it is possible to obtain a greater income, owing to the fact that out-of-season crops produce out-of-season prices.

5. Pleasure is derived both from raising and from consuming crops grown out of their natural season.

Considering these advantages, it does not seem possible that either

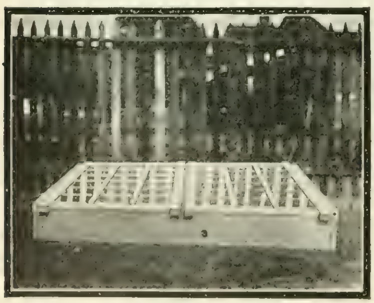

FIG. 8.—*The finished pit ready for use*

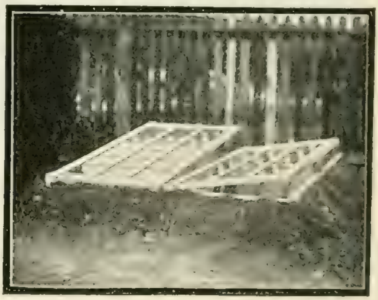

FIG. 9.—*Two methods of ventilating the hotbeds*

the home or the commercial grower is obtaining maximum results from his garden if hotbeds are not included in the garden outfit.

*Figs. 6 to 9 used by courtesy of Sunlight Double Glass Sash Company, Louisville, Kentucky.

LOCATION OF THE HOTBED

When the question of hotbeds is brought up for definite consideration one of the first questions to be settled is, where shall the bed be located on the farm or home grounds? Generally speaking, a southern exposure, with a windbreak in the form of a barn, dwelling, or trees that will give shelter and protection from the north winds, affords the most suitable site. Where there are no buildings nor tree hedges available for shelter, a 6- or 7-foot board fence can be constructed on the north side of the hotbed pit. Usually, this fence is built by setting posts, 6 to 8 inches in diameter, at least 3 feet deep in the ground and 8 to 10 feet apart.

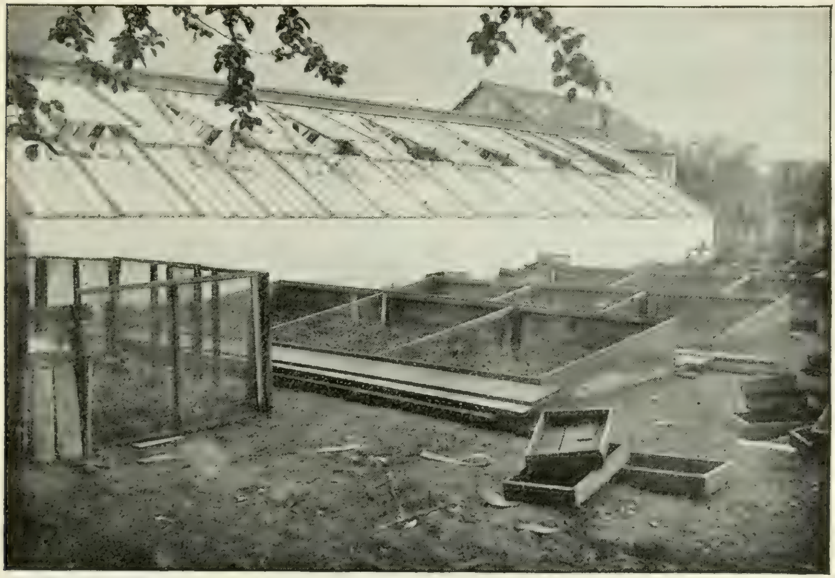

FIG. 10.—*A series of three-sash hotbeds, of cheap construction, used on a small commercial plant*

These posts extend upward 6 to 8 feet, having a slight northern cant. Sometimes a short brace is placed against them on the northern side about 3 feet from the ground, being either driven into the earth or attached to stakes that are so driven. Boards, generally matched, are then nailed on the south side of these posts. Such a fence will give ample protection to the hotbed and good satisfaction to the gardener.

CONSTRUCTION OF A HOTBED MADE ENTIRELY OF WOOD

After the site has been chosen, the next step is to stake out the ground for the work of excavation. At least 3 feet, and preferably 4 feet, should be allowed between the back of the hotbed and the windbreak. This

provides ample room for walking around and working in the hotbed. A stake is placed, at the required distance from the windbreak, at the east end of where the pit is to be and another stake at the west end, allowing an extra foot for space in which to work while the woodwork is under construction. The distance between the east stake and the west stake will be in accordance with the number of beds that are to be made, plus 1 foot. If but one bed is made, 3 feet will be allowed for the bed and 1 foot for working space; if a frame of four beds is to be made, then, considering the width of each bed to be 3 feet, the distance between stakes

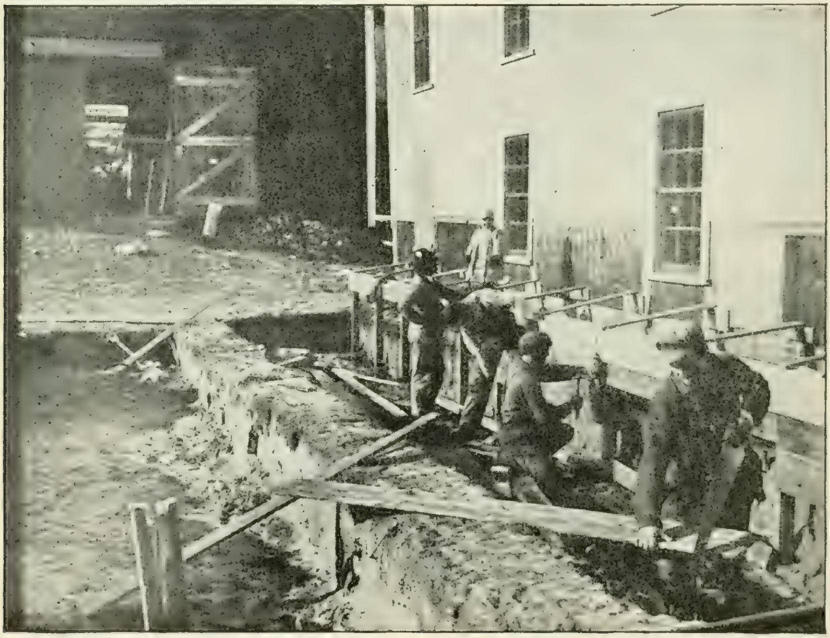

FIG. 11.—*A practicable hotbed, constructed as described in text*

will be 13 feet; and so on, according to the number of beds to be made in one range.

Stakes are now placed 7 feet south of the east and the west stake. The distance east and west between the last stakes placed should be the same as that between the first two. A line is stretched around these four stakes and the work of digging out the soil is begun. If the land is level the hole, or pit, should be 30 inches deep, and the dirt should be thrown out on all sides so that it can be used later for filling in and grading. Although a depth of 30 inches may seem rather great for hotbeds farther south, yet for average conditions in New York and in the northern United States,

and where the bed is to be used for any length of time, this depth will be found very satisfactory. Nevertheless, the depth of bed is but a slight factor in hotbed construction and may be changed at will by the operator, who can either make the pit shallower or fill with other material than manure on the lower level (page 1626). The depth of the pit will be regulated by local conditions.

New stakes are driven 6 inches south of the first stakes placed on the east and west ends, and these should be set far enough from the edge of the excavation to be firm. These stakes are connected by a line, drawn tight. This line then represents, in the case of an all-wood pit, the front

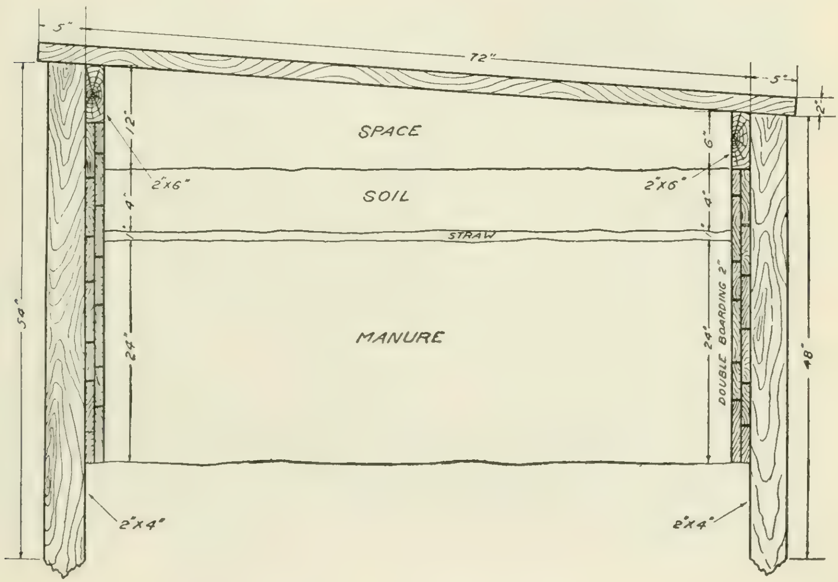

FIG. 12.—*Cross-section of hotbed*

or south side of a row of posts or 2x4-inch scantlings that are to serve as the support of the back boarding. These posts or scantlings should be sunk in the soil at least 1 foot, and preferably 18 inches, below the bottom of the bed. They should extend 42 inches above the bottom of the bed, each one being set plumb with the line. The distance from the middle of one post to that of the next is 4 feet except in case only one or two beds are installed, when a distance of 3 feet is better. When all the posts are set, 2x6-inch planking is nailed with twenty-penny nails along their tops, 42 inches being provided for from the bottom of the pit to the top of the planking. By the use of a carpenter's level the top of the planking can be made in one plane, or level. The planking can

be braced with short scrap pieces of boards and stakes, so that it will not change its location nor be thrown out of plumb.

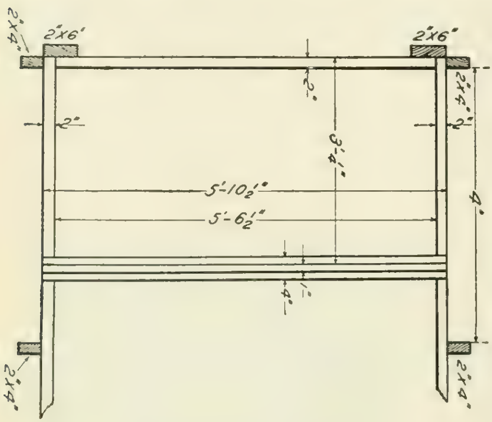

FIG. 13.—*Corner of hotbed*

The next step is the construction of the front of the pit. This is made just as was the back, with posts or 2x4-inch scantlings and with top planking, differing only in that the distance from the bottom of the pit to the top of the planking is but 36 inches. This planking also should be well braced.

The distance from the south face of the back posts to the north face of the front posts, on a level plane, is 5 feet 10½ inches, and from the north face top edge of the back planking to the south face top edge of the front planking it should be 6 feet. This allows for a 6-inch fall, or slope, of the sash when placed on the bed.

The boarding under the top planks, on both the back and the front scantlings of the pit, can be either 2-inch planking or, better still, common boards such as scrap lumber or short pieces. It is to be of double thickness, care being used in covering joints and cracks with the inner layer. In the author's experience, this boarding has given complete satisfaction.

The ends of the bed are either planked or double-boarded from the bottom of the pit to the top of the front of the bed. The end boards are nailed to a short piece of 2x6-inch plank fastened to the ends of the back boarding, and also to pieces nailed vertically to the ends of the front boarding. For a top piece to properly fill in the space left, a 2x6-inch plank is split across corners so that two pieces 5 feet 8½ inches long are obtained, one end of each being 6 inches wide and the other end tapering down to $\frac{1}{16}$ of an inch or less. The tapering pieces are then laid on the top

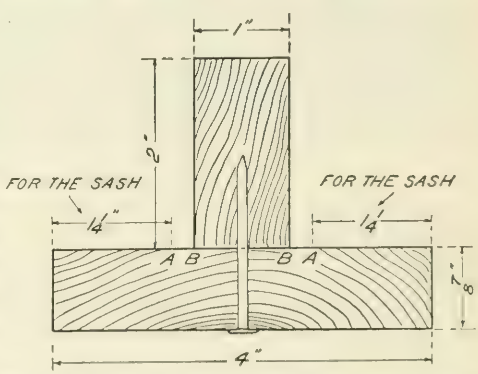

FIG. 14.—*Cross-section of crosstie. The space between A and B allows for swelling of wood and for free movement of sash*

of the end boarding and nailed firmly. These tapering pieces correspond to the fall, or slope, of the sash when it is laid on the bed.

The bed is now ready for the crossties. These are generally strips of boards 4 inches wide and 6 feet long. They are counter-sunk into the top of both the back and the front of the bed, being spaced so that $1\frac{1}{4}$ inch of the outer edge on each side is for the use of the sash, the middle inch allowing for a small 1x2-inch strip of wood to be nailed upright and to serve as a separator between sashes, and the remaining half-inch allowing room on each side for swelling of the sash. (Fig. 14.)

The bed is now finished and ready for the filling in of the dirt and

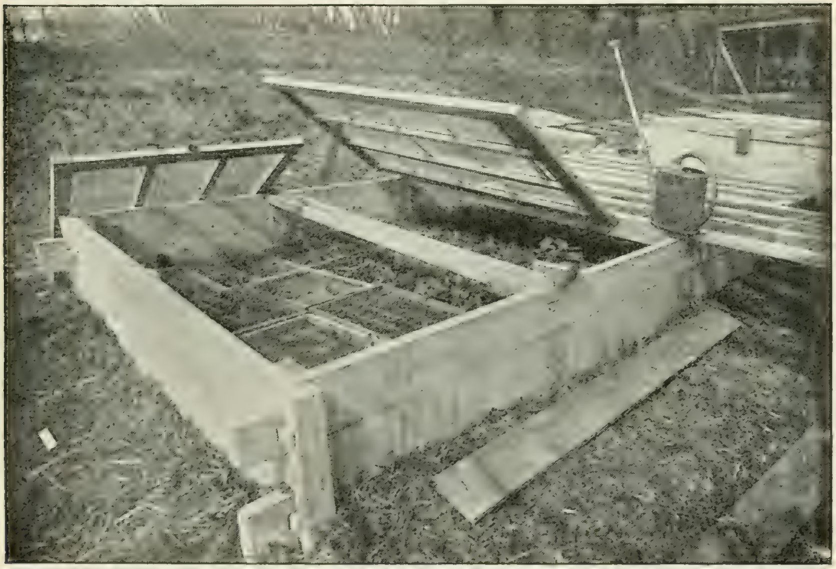

Fig. 15.—*Hotbed made of a pile of manure and a cold-frame top. Flats inside filled with seedlings. For the farm garden*

for the grading. As the dirt is filled in it should be firmed, making a tight connection between the surrounding soil and the bed. Care must be taken, however, that the dirt is not filled in on one side more than on the other, as this is likely to throw the bed out of plumb. The soil all around the bed should be graded so that all water is drained away from, not toward, the bed; but the grading should be gradual, not sharp. Coal cinders, used for a top layer near the bed, make a very good walk.

CONSTRUCTION OF HOTBEDS NOT MADE OF WOOD

Not only may hotbeds be constructed entirely of wood, as described above, but other materials, such as concrete, brick, stone, or combinations of these, may be used.

Hotbeds of concrete

In the case of concrete, a form of plank or of boards is built, having for its inside measurements — which are those of the inside wall of concrete — the same inside dimensions as for the all-wood bed. The wall of concrete, however, should be at least 3 inches thick at the top and it is generally best to have it 4 or 5 inches thick at the bottom, the inside face being perpendicular and the outside face sloping slightly. The depth

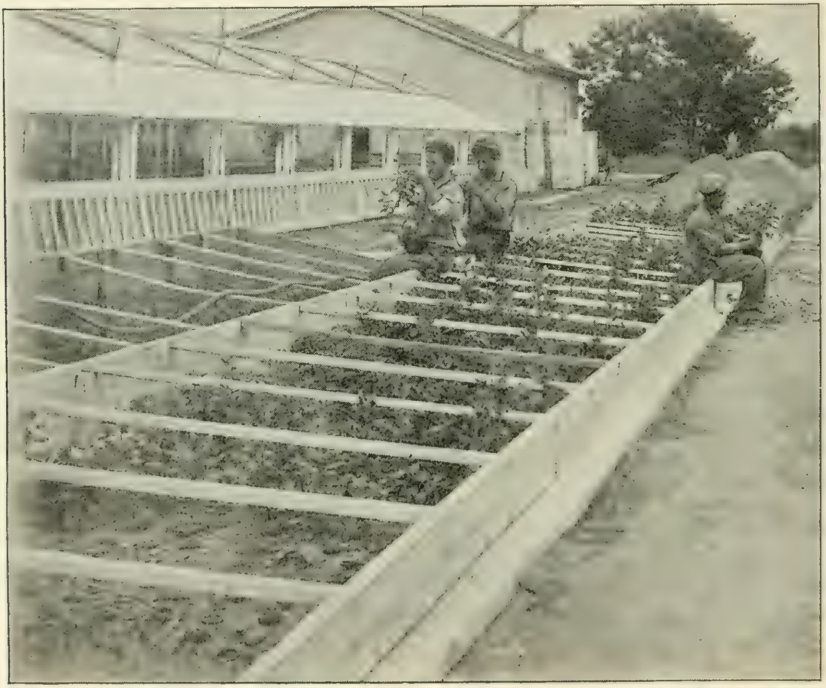

FIG. 16.—*Hotbed. Pit of concrete, top of wood. This will last a lifetime*

and the difference in height of the front and back walls, with the ends to correspond with the slope of the sash, are the same as for the bed previously described. One additional construction is needed — that of several quarter-inch bolts, 7 inches long, set upside down in the top of the concrete. These bolts are for fastening the plank sill to the concrete.

After the hole is dug and the form constructed, it is necessary to mix the concrete and fill the form. The following proportions make a good mixture: 100 parts of cement, 200 parts of sand, and 400 parts of fine gravel. The gravel is placed on a board platform and spread out 3 to 4 inches deep. Over this the sand is scattered, and the cement is laid over

the sand. With square shovels this dry mixture is turned twice. Then water is added, care being taken that none of the water runs off as in doing so it carries away fine particles of cement. As the water is added the mixture is turned again, and when more water is needed it is applied. The turning is continued until the whole mass is thoroughly wet and slightly sloppy. At this stage it is shoveled into the form, and tamped down with a blunt 2x3-inch scantling in order that all parts of the form may be filled solid. It is quite important, in filling, that the whole form be filled alike on all sides; then, if it cannot be filled in one day, the top can be moistened with water just before the first batch of concrete is put in the following morning, thus making sure the union between the work of the two days.

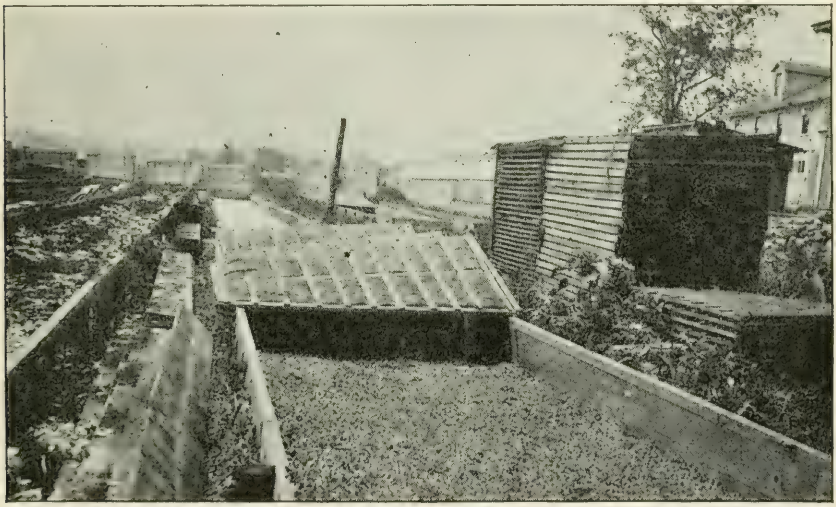

FIG. 17.—*Commercial hotbeds. A cheaply constructed mat of lath and straw in the middle of the bed*

When the form is completely filled and the concrete is leveled slightlyhigher than the woodwork of the form, short pieces of boards are laid over the top, but not touching the concrete, for protection against rain. In two or three days the form may be carefully removed and the sides of the concrete exposed directly to the weather. Care must be taken, however, that the concrete does not dry out too fast, or it will crack and sometimes heave. A few pails of water thrown on will stop this quick drying; or, on very sunny days, boards or lath screens covering the bed will serve the purpose.

A 2x4-inch sill set in the cement and fastened by the bolts, lapping at the corners, is then placed on the bed and is to serve as a rest for the sashes. Crosspieces, such as are spoken of for the wooden beds, may be countersunk into the sill. The bed is then ready for filling and for the sash.

Hotbeds of brick and stone

Brick or stone may be employed in place of concrete, either for the entire construction or using brick or stone below the ground and a wooden top 12 inches high in the back and 6 inches in front. In using brick or stone, the inside face of the walls should be as smooth as possible and all cracks should be filled with mortar. If the brick or stone is carried to the full height, a few bolts, as in the concrete structure, should be used to fasten the sill. Crossties should be used, and the whole construction should be similar to that of the concrete bed.

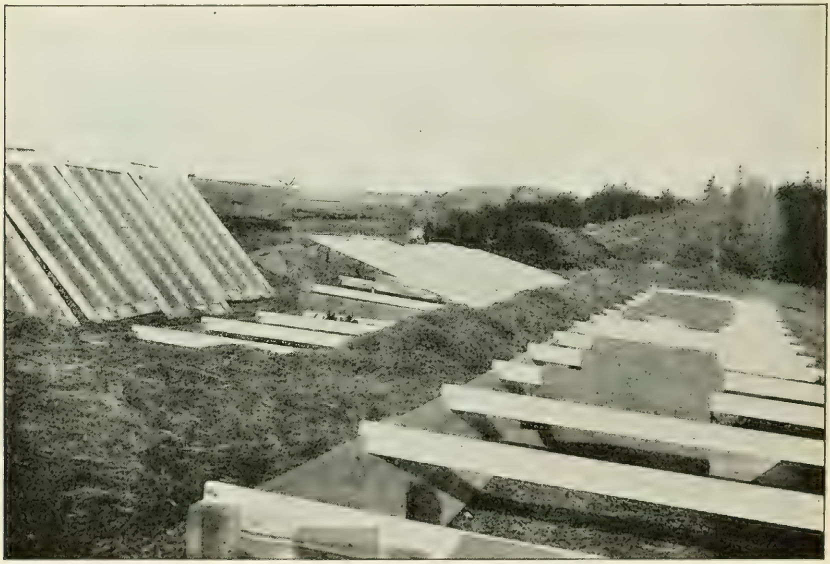

FIG. 18.—*Substantially built hotbed pits, empty, waiting for the manure*

RELATIVE ADVANTAGES OF VARIOUS MATERIALS FOR HOTBED CONSTRUCTION

The advantages that brick, stone, or concrete pits have over wooden pits are: first, they are quite free from rats and mice; second, the bed, once built, is permanent. The principal drawbacks are the extra expense over that of wooden pits, both in cost of material and in cost of labor, and the fact that the brick, stone, or concrete pits cannot be easily removed.

SASH

Sash 3 x 6 feet in size may be bought from reliable firms dealing in greenhouse material, or from many of the large lumber firms. Unglazed sash costs about $1.25 to $1.75, and the glass for glazing may be procured,

in 10x12-inch size, for $2\frac{1}{2}$ to 4 cents per pane. Putty can be obtained at a paint or hardware store, or it can be made by mixing white lead, linseed oil, and whiting. Points are procured at small expense.

For glazed sash the prices are as follows: single-glass sash, $2.75 to $3.50; double-glass sash, $4.50 to $6. If bought in large quantities the price is lower.

Homemade and serviceable sash, with either single or double glass, may be made by any one skilled in the use of tools. Either cypress or

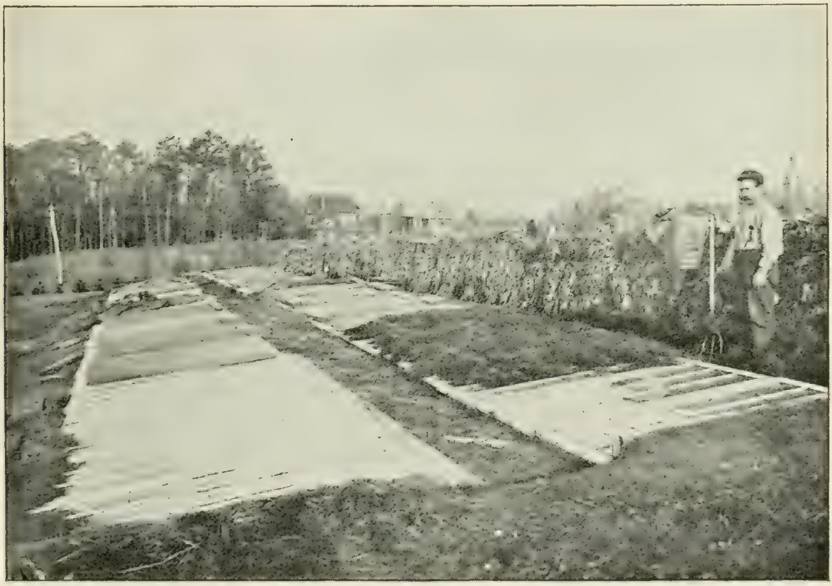

FIG. 19.—*Hotbeds in winter. Sash closed. Straw mats on some of the sash, loose straw on other sash, both for protection. Cornstalk fence to protect the beds from north winds*

white pine can be used, dimension lumber being ordered. The joints should be carefully made, and a rabbet plane may be used in finishing.

It is very important that the sash be kept well puttied and painted.

PREPARATION OF THE BED

As a general rule, the construction of the hotbed takes place in the late fall or early winter, and after being finished the bed is covered with boards or shutters in order to keep out snow and ice. The covering is taken off very early in the spring, usually six to eight weeks before plants can be set outdoors. In heating beds the common material used is horse manure, and this is the practice to be emphasized here. Hotbeds may be heated, however, by hot water, steam, or flues, the pipe that carries the heat running

through the soil or under a false bottom in the pit and thereby giving to the plants bottom-heat similar to that supplied by manure.

As soon as the beds are open, the horse manure — which has previously been piled and brought to a uniform heating by one or two turnings — is forked into the pit. As each layer of 4 to 6 inches is put in, the manure is tramped level and slightly pressed down. This filling in and tramping of the manure is continued until the pit is filled to a point within 8 inches of the top of the plank on the front of the bed and 14 inches of the top of

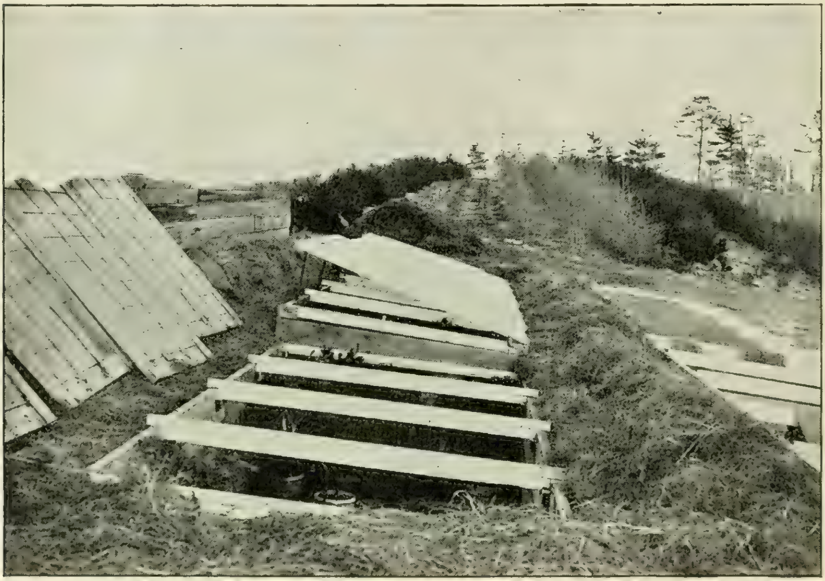

FIG. 20.—*Hotbed pits used for storage of flowering and ornamental hotbed plants*

the plank on the back of the bed. A thin layer of 3 to 4 inches of loose, dry straw is then placed over the manure. This straw allows for a more even distribution of the heat that arises from the fermenting manure, and practically does away with later "hot spots" in the soil.

Prepared hotbed soil, to a depth of 4 inches, is placed over the layer of straw. This soil is composed as follows: either 1 part sand, 1 part leaf mold, 1 part manure (well rotted), and 1 part good garden soil, screened through a half-inch-mesh screen; or, as is the practice of many gardeners, 1 part well-rotted manure and 1 part good garden soil, screened as above. Whichever method is used, the prepared soil is generally placed in piles and turned two or three times during the year so as to be well mixed. This is called composting. It usually takes two years of composting to obtain the best soil, although compost one year old will give satisfaction.

The soil is raked smooth and level and the bed is closed by placing a sash over it. At first the temperature will rise very high, but after one or two days it will drop. When the temperature reaches 85° it is well to begin to plant the seed. The temperature referred to is that of the soil, not that of the air, the latter being regulated by raising or lowering the sash. The position of the sash will, of course, have some influence on the soil temperature.

MANAGEMENT OF THE HOTBED

All small seeds, such as radish, lettuce, cabbage, tomato, cauliflower,

FIG. 21.—*Commercial semi-hotbeds filled with a good crop of cucumbers*

aster, pansy, and the like, should be planted in rows, with 3 inches between rows and $\frac{1}{4}$ to $\frac{1}{2}$ inch between seeds, and at an average depth of $\frac{1}{4}$ inch. Lines, or furrows, are made by pressing the edge of a board into the soil. The seed is sown in these lines, or trenches, and covered with soil, the whole being pressed firm with a flat board and water sprayed on through a fine nozzle. Close attention should be given to the watering, which should be done early every sunny morning.

Still closer attention should be given at all times to ventilation by raising or lowering the sash. Not only does this ventilation permit necessary fresh air to come in and discarded air to pass out, but it has a great influence on the temperature. When one understands that there are certain temperatures which are agreeable to each of the many plants, the reason for adequate ventilation and maintenance of the proper temperature is clear.

It is enough to say that the temperature under the glass should not be allowed to rise above 75° in the daytime or to fall below 50° at night for average plants. Many gardeners watch the glass, and, if moisture condenses on it, more air is admitted by raising the sash. The sash is never raised so that a direct wind will blow in on the plants, but is raised away from the prevailing wind.

Under the above conditions the seeds will have the correct environment for germination and growth.

As soon as the first true leaf is developed (the first true leaf is generally the third leaf appearing, the first two being seed leaves, or cotyledons), those plants that are to be given more space for development are trans-

FIG. 22.—*Commercial hotbeds of the cheapest construction. Laborers harvesting a crop*

planted to another hotbed in rows 3 to 4 inches apart, the plants being $2\frac{1}{2}$ to 3 inches apart in each row. In the case of tomatoes and other plants that make a large growth, these will again be transplanted, when the outside weather is settled, to their permanent places in the field. Lettuce, however, can be set 7 x 7 inches apart in the hotbed and allowed to mature there.

Many other plants can properly be brought to maturity in hotbeds. Sweet corn and snap beans are often thus planted and matured. In their early stages of growth these plants do not require the space that is needed later. This space can very wisely be used for a more quickly maturing catch crop, such as radishes or lettuce, and the early waste of space is thus avoided.

There are many combinations of vegetables that can be grown in a hotbed. Radishes, lettuce, beets, and carrots seem to be well adapted

for growing together; while tomatoes, eggplants, and peppers, although they can be raised with the others, will grow better if given a higher temperature than, and conditions slightly different from, those required

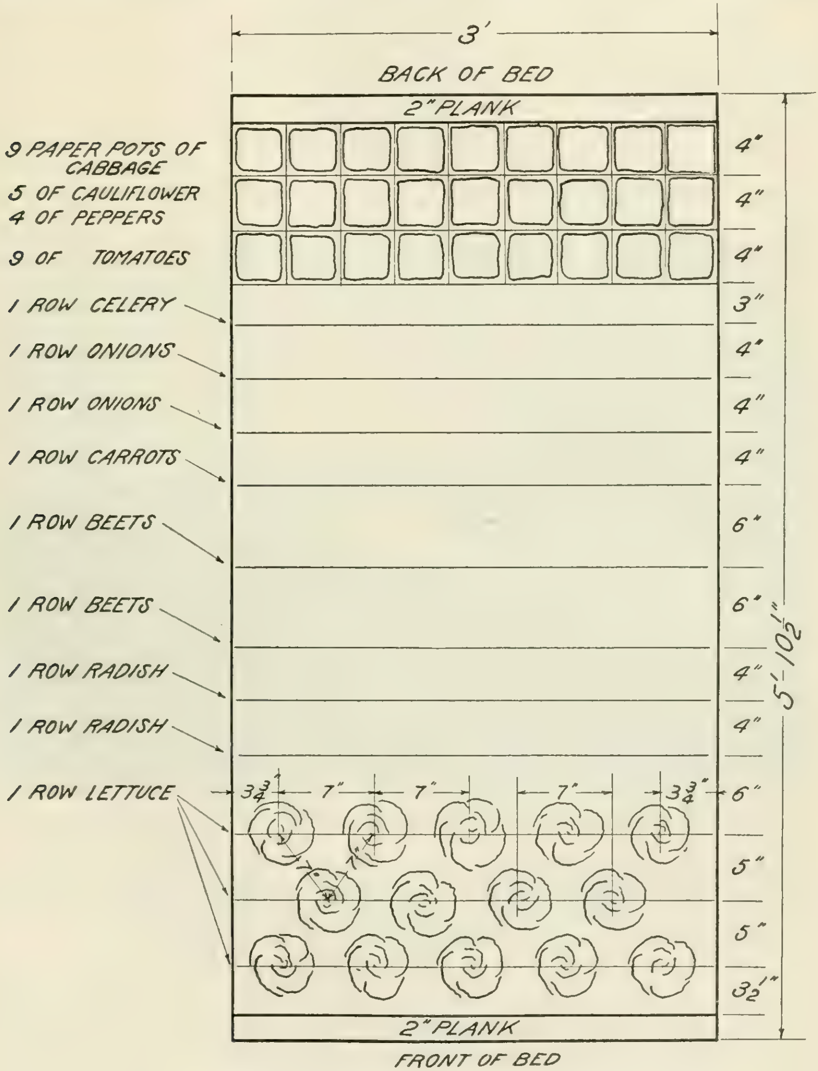

FIG. 23.—*Plan for hotbed planting*

by the first four plants named. Through experience the various requirements of different plants will become known to the grower.

A good plan for planting a hotbed for the home garden is shown in Fig. 23. The cabbage, cauliflower, tomatoes, and lettuce that are trans-

planted to this bed can be first raised in a small flat,* either earlier in this bed, in another bed, or in the house at a sunny window or behind the stove. Other plants, such as radishes, beets, and carrots, are sown for maturing in this bed. For the best results they will require thinning, the beet thinnings being used as greens. The seed of celery and of onions is sown and the seedlings are transplanted later.

After the lettuce plants have been disposed of, one row of cucumber seeds may be planted, the plants being thinned later to 6 inches apart. Cucumbers may be planted also after the pots at the back of the bed are removed. The cucumber plants are then allowed to spread at will and

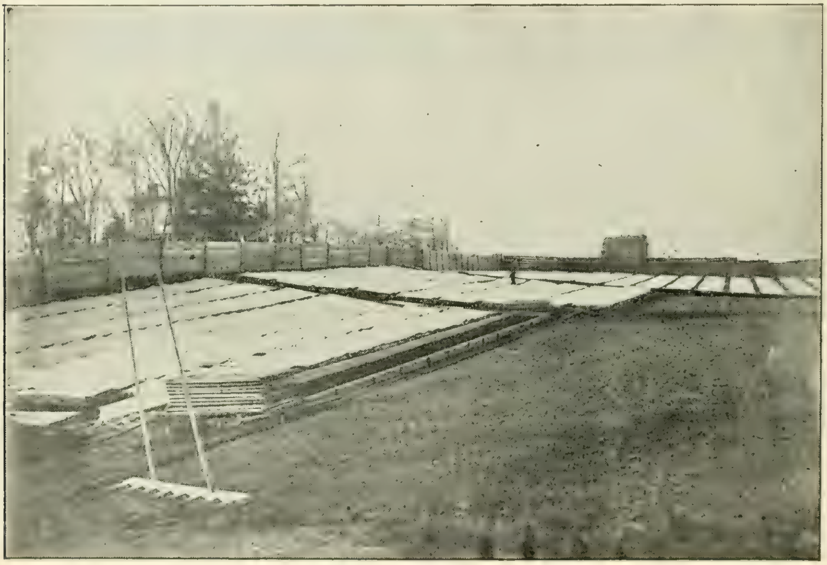

FIG. 24.—*Commercial hotbed yard. Notice the high board fence at the north of the yard*

to mature a crop of cucumbers for slicing or for other uses as required. For commercial purposes, only one kind of plants is grown throughout the bed or several beds, and transplanting is on a large scale.

After one crop is taken out another can follow, the soil in the bed being forked over and raked level between crops, and after the manure is spent the bed can be used for the development of vegetables throughout the summer. In the fall the soil and the spent manure is taken out of the hotbed pits, the sash is stored away, and the board covering is replaced for winter protection. Fresh manure is used every spring, also fresh soil, the process of making and managing the hotbed changing only as the operator becomes more experienced in successful hotbed work.

* A flat is a wooden box 12 inches wide, 18 inches long outside, and 2½ inches deep inside, filled with dirt.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. Bailey, *Director*

Course for the Farm, Royal Gilkey, *Supervisor*

VOL. II. No. 30 | ITHACA, N. Y. DECEMBER 15, 1912 | VEGETABLE-GARDENING SERIES No. 1

HOTBED CONSTRUCTION AND MANAGEMENT

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. The answering of the questions is optional, but a majority of readers accept this opportunity for additional work. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read.

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Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

1. Of what value is the hotbed to the home garden?

2. Of what value is the hotbed to the commercial grower?

3. Give a sketch and description of the construction of a hotbed that you have used or have seen.

4. Give a list of the plants that you have grown in a hotbed, with a sketch showing their position.

5. Illustrate and describe some method, other than using manure, for heating a hotbed.

6. Describe in detail the watering of plants in a hotbed.

7. Give in detail your methods of ventilating a hotbed.

8. Describe your method of planting seed in a hotbed, as to date of planting, opening of furrows, depth of planting, and the like.

9. If you are a successful grower having started in a small way with hotbeds, outline the growth of your business.

10. What are the advantages and disadvantages of (a) single-glass sash? (b) double-glass sash?

11. Do you use mats and shutters? If so, why?

Name..................................

Address................................

Date....................

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL II. No. 32 | ITHACA, N. Y. JANUARY 15, 1913 | DAIRYING SERIES No. 2

COMPOSITION OF MILK AND SOME OF ITS PRODUCTS

H. E. Ross

Milk is one of our most important foods. Since its food value depends to a considerable extent on its composition, a knowledge of its composition is desirable for every one.

The color of milk is yellowish white, a color somewhat difficult to describe accurately. It is so characteristic of milk that we often refer to

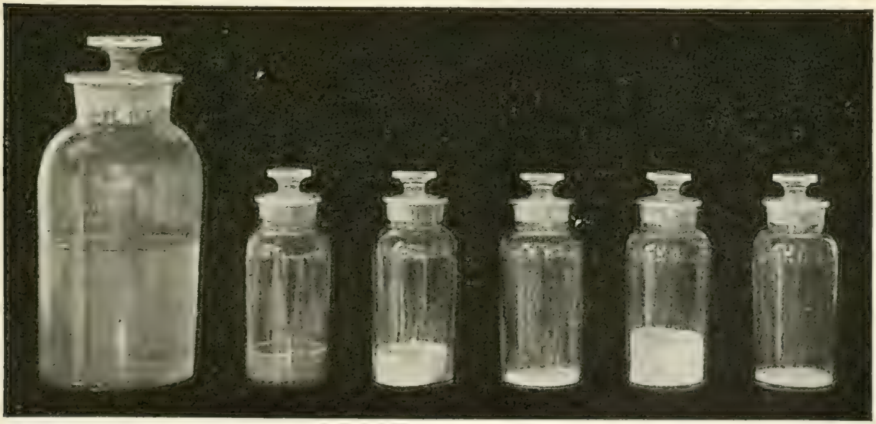

FIG. 25.—*The constituents of a quart of milk*

Water	Fat	Casein	Albumen	Sugar	Ash
87%	4%	2.6%	.7%	5%	.7%
29.93 oz.	1.38 oz.	.89 oz.	.24 oz.	1.72 oz.	.24 oz.

the color of certain objects as "milk white," thus giving to milk a distinctive color of its own. This peculiar color is due to a substance called lactochrome.

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The taste and odor of milk are sweetish, although pure milk has little of either. If there are strong flavors and odors they are due to the food eaten by the animal or to contamination of one kind or another, such as may result from dirty stables or unclean utensils.

Freshly drawn milk has a double, or amphoteric, reaction. It acts as an acid on an alkali and as an alkali on an acid, turning blue litmus paper red and red litmus paper blue. After standing for a time the reaction usually becomes decidedly acid, due to the action of lactic-acid bacteria. These bacteria, or germs, work on the milk sugar and convert it into lactic acid.

When milk is boiled in an open vessel a heavy scum of dried milk forms on the surface. If this scum is removed another will appear as soon as the milk is boiled, and such a membrane will form as long as any milk is left. If milk is boiled in a closed vessel the scum does not form.

For all ordinary purposes milk may be said to have six constituents, which, together with the percentage of each, are as follows:

	Percentage
Water	87.0
Sugar	5.0
Fat	4.0
Casein	2.6
Albumen	.7
Ash	.7

For many reasons, some of which are not well understood, the composition of milk is variable. The physical condition of the cow, the kind of food given, the housing, and the age of the cow are four things that may affect the composition. Wing, quoting from Koenig, gives the following variation of normal milk:

	Percentage	
	Maximum	Minimum
Water	90.69	80.32
Sugar	6.03	2.11
Fat	6.47	1.67
Casein	4.23	1.79
Albumen	1.44	.25
Ash	1.21	.35

Of course, single variations may be found that go either above or below the limits given in the table; but the figures presented are the results of a large number of analyses of samples of normal milk.

For purposes of convenience the content of milk is grouped in several divisions, as represented in the following table:

<table>
<tr><td></td><td>Water</td><td></td><td></td><td>Fat</td><td></td></tr>
<tr><td rowspan="5">Total solids</td><td>Fat</td><td></td><td rowspan="5">Milk serum, or skimmed milk</td><td>Water</td><td rowspan="3">Whey</td></tr>
<tr><td>Sugar</td><td rowspan="4">Solids-not-fat</td><td>Sugar</td></tr>
<tr><td>Casein</td><td>Albumen</td></tr>
<tr><td>Albumen</td><td>Casein</td><td></td></tr>
<tr><td>Ash</td><td>Ash</td><td></td></tr>
</table>

There is a small amount of ash in whey, also, and this is the part that is soluble.

The density of milk is greater than that of water, the specific gravity of normal milk being 1.029 to 1.034, with an average of 1.032. The specific gravity of milk is affected by variation in the milk solids. The New York State laws require that milk must contain not less than 11.5 per cent of total solids, of which at least 3 per cent shall be fat.

One quart of milk weighs 2.15 pounds. While milk is variable in composition, the variation is not enough to make a great difference in the weight of one quart. This factor, 2.15, is the one used in changing quarts to pounds or pounds to quarts.

COLOSTRUM

The milk secreted by the cow a few days before and a few days after the birth of a calf is called colostrum, or beestings. It differs in appearance and composition from normal milk and its composition is variable. Usually, colostrum is low in sugar and fat, and high in albumen and ash. The following table, taken from Fleischman, gives the average composition and the maximum and minimum variation of colostrum:

	Percentage		
	Average composition	Maximum variation	Minimum variation
Water	71.69	70.60	67.43
Fat	3.37	4.68	1.88
Casein	4.83	7.14	2.64
Albumen	15.85	20.21	11.18
Sugar	2.48	3.83	1.34
Ash	1.78	2.31	1.18

It is highly desirable that the young calf receive the colostrum, for this food acts as a purgative and a stimulant to the digestive system of the young animal.

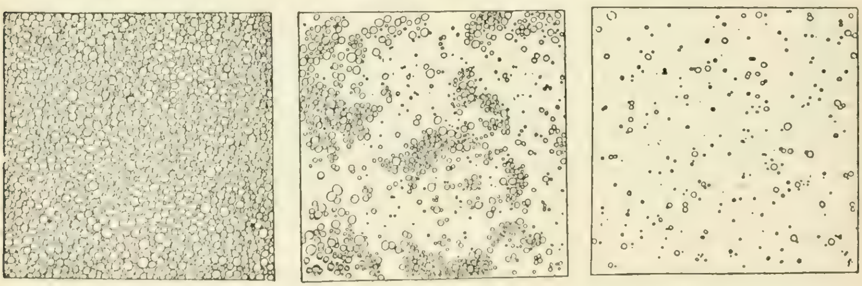
Colostrum is not considered fit for human consumption. Previous to the secretion of colostrum the udder has usually been in a state of inactivity, and just before or just after the birth of the calf it suddenly becomes very active. This sudden activity may result in more or less inflammation; and whenever there are inflammatory conditions, poisons that may be harmful to the human system are likely to be given off. The New York State dairy laws regard colostrum as one form of adulterated milk, and prohibit the sale of milk from a cow either fifteen days before or five days after calving.

By referring to the above table showing the composition of colostrum, it will be noted that there is a high percentage of albumen. Since heat readily coagulates albumen, boiling the milk is used as a test to determine when it has passed from the colostrum to the normal stage. Because of its high albumen content, colostrum thickens at once when boiled. Normal milk does not thicken when boiled.

CONSTITUENTS OF MILK

Milk fat

Fat is one of the most important constituents of milk. As a food milk is better if it contains a fair percentage of fat than if this percentage is small. For manufacturing purposes, milk fat is very important. One of



Cream Milk Skimmed milk

FIG. 26.— *The appearance of cream, milk, and skimmed milk when examined through a high-power microscope. The round bodies are fat globules that float in the serum, or watery part of the milk*

the best illustrations of this is in the manufacture of butter, which is largely fat. Also, more cheese can be made from one hundred pounds of milk rich in fat than from the same quantity of milk with low fat content. The amount of fat in milk is so important that milk is frequently bought on the fat basis. The percentage of fat in milk is usually determined by the Babcock test.

Fat exists in milk in the form of small droplets, or globules, forming an emulsion — that is, a liquid with the fat in a state of fine suspension; the fat is not in solution. This condition is favorable for digestion. Each globule is spherical in form and it keeps this form by reason of its power to condense about it the liquid part of the milk.

The fat globules are very tiny, being about 1/1,500 to 1/25,000 of an inch in diameter. A high-power microscope is required in order that they may be seen, and some idea of their minuteness may be obtained when it is stated that in one cubic centimeter of milk (about 22 drops) there are one to two billion fat globules.

The fat is lighter than the other constituents of milk, and when milk is allowed to stand the fat globules rise to the surface, forming what is called a "cream line." This layer of cream can usually be seen distinct from the rest of the milk. The presence of a thick cream line indicates that the milk is rich in fat. The absence of a cream line is not, however, a positive proof that there is a small percentage of fat in the milk, although it indicates that such is the case. The writer has sometimes found milk testing 4.2 per cent fat which showed almost no cream line. Just why the fat does not always rise readily is not fully understood.

Milk fat is not one fat alone, but is made up of about nine different fats. These all have different properties and the character of the butter is influenced by the kinds of fat of which it is composed. One of the fats in milk is called "olein" and another is called "stearin." Olein has a melting-point of about 43° F. and stearin a melting-point of about 143° F. The melting-points of the other fats lie between these limits. The melting-point of butter is therefore variable according to the amount of the different fats present, and is between 92° and 96° F. One of the fats in milk, called "butyrin," is the characteristic fat of butter because it imparts the flavor and odor that are recognized as butter flavor and butter odor.

All the fats in milk fat have the same basis, which is glycerin. They are formed by the union of glycerin with the corresponding fatty acid. For example, butyrin is made up of glycerin and butyric acid; olein is composed of glycerin and oleic acid. Nearly every one has had experience with strong, or rancid, butter. Such rancidity is due to the splitting up of butyrin into butyric acid and glycerin. The butyric acid produces the strong, disagreeable flavor and odor. It is a strange fact that no chemist can make in the laboratory any of the fats of milk fat. The cow alone can do this. A chemist might be given glycerin and butyric acid, with all laboratory facilities, but he could not make butyrin.

Fat is the most variable constituent of milk. There are several conditions under which it varies, the reasons being not always understood. Some of the reasons are as follows:

1. Variation due to breed. This fact is well known and needs no discussion.

2. Variation due to age of the cow. As the cow grows older, the percentage of fat decreases.

3. Variation due to physical condition of the cow — whether she is sick or well. It cannot be predicted whether the percentage of fat will increase or decrease.

4. Variation due to period of lactation. The percentage of fat increases as the period of lactation advances.

5. Variation between animals of the same breed. This is to be expected, since individuals always vary.

6. Variation in different parts of the udder. The first milk drawn is very poor in fat and the last milk drawn is very rich in fat. Often there will be a variation of one to nine per cent between the first and the last milk.

Milk fat compares well with other fats in digestibility.

Casein

Casein, popularly called "curd," exists in milk in a colloidal state, that is, in a state of very fine suspension. The particles of casein are in much finer suspension in milk than are the fat globules; the fat globules may be seen with the high-power microscope, but the casein cannot be seen at all. Casein is held in suspension by calcium salts, and when anything forms in milk or is added to it which unites with the calcium salts the casein is thrown down. This is what happens when milk sours naturally. Acid forms in the milk, uniting with the calcium salts, and the casein comes down in a mass.

Casein forms a considerable part of the various kinds of cheese. American cheddar cheese is about one third casein. In either milk or cheese, casein is a very excellent food. It is high in nitrogen content; and this is one reason why whole milk and skimmed milk are excellent foods for growing animals.

Milk casein has many important commercial uses. It is used to finish writing-paper, much of our finest stationery being finished with it. It is used as a substitute for bone and celluloid in the manufacture of buttons, backs of brushes and combs, and many toilet articles, and is employed as a basis in the manufacture of cold-water paints and of glue.

Milk sugar

Milk contains about 5 per cent sugar and this percentage is fairly constant. The sugar is in solution; it is not quite so soluble as ordinary cane sugar, and not so sweet. Milk sugar is used commercially in the manu-

FIG. 27.— *Students' milk-testing laboratory, Department of Dairy Industry, New York State College of Agriculture at Cornell University*

facture of proprietary foods, and in pharmacy for coating pills and making powders. The manufacture of milk sugar is an expensive process and is carried on only where large quantities of skimmed milk or whey are available.

Milk sugar is of great importance in dairy manufacturing because the acid in milk and cream is produced from it and we have come to like dairy products the flavor of which is affected by the formation of this acid. The public demands a butter made from cream soured with lactic acid. In the manufacture of American cheddar cheese the amount of acid formed at different stages in the process of manufacture greatly affects the kind and quality of the product.

Lactic acid, as found in milk, is made by the action of lactic-acid bacteria on milk sugar. These bacteria, or germs, are found nearly everywhere in external nature, and occur on the body of the cow, on the dust in the air, and on the clothing of the milker. Unless precautions are taken these germs get into the milk, and under conditions favorable to them they multiply rapidly and cause the milk to sour. The chemical reaction that takes place is given as follows:

$$\begin{array}{rcl} \text{Milk sugar} & = & \text{lactic acid} \\ C_{12}H_{22}O_{11} \cdot H_2O & = & 4C_3H_6O_3 \end{array}$$

Milk sugar is found nowhere in nature except in the milk of animals of the class known as Mammalia.

Albumen

Albumen is a nitrogenous substance in solution in milk; being in solution, it is easily digestible. In composition it may be compared to the white of egg. It is precipitated by heating to about 160° to 170° F., and when once thrown down it will not go into solution again. The fact that albumen is precipitated by heat is the reason why milk utensils, when cleaned, should be first rinsed in cold water. If hot water is used first the albumen is precipitated on the utensil, and, being sticky, is difficult to remove. If there are cracks or seams in the utensil some of the precipitated albumen lodges in these; and since albumen is an excellent food for bacteria the utensil soon becomes a source of contamination for all milk that comes in contact with it.

Albumen has one commercial use — in the manufacture of Italian cheese. This cheese is made where large quantities of whey are obtainable. The whey is heated to a high temperature, which precipitates the albumen. The albumen is allowed to collect, the whey is then drawn off, and the albumen is drained and dipped into molds. This cheese is more or less tasteless since there is very little flavor to albumen; but it is very nutritious.

Ash

The ash of milk is the part left after milk has been dried and burned, and contains the mineral matter of the milk. It is partly in suspension and partly in solution. The ash is the most constant constituent of milk and rarely goes below .68 or above .72 per cent.

Ash is important for growing animals because it contains material necessary for bone formation. Some of the minerals found in the ash of milk are salts of sodium, potassium, magnesium, and phosphorus.

CREAM

Cream is milk in which a large percentage of fat has been collected. The increase in percentage of fat means, of course, a corresponding decrease in the percentage of the other milk constituents. The New York State dairy laws specify that market cream shall contain not less than 18 per cent of fat. Often the percentage of fat is much higher, and when cream is shipped it is sometimes made to contain as high as 50 or 60 per cent of fat in order to save transportation rates.

Fleischman gives the composition of cream having high and low percentages of fat as follows:

	Percentage	
	Cream high in fat	Cream low in fat
Water	29.0	76.6
Fat	67.5	15.2
Casein, Albumen	1.2	3.1
Sugar	2.2	4.5
Ash	.1	.6

The principal uses of cream are in the manufacture of butter and for market purposes. Cream is a good food, but it is usually regarded as an expensive food. For example, comparing cream at 40 cents per quart with whole milk at 8 cents per quart, it will be seen that five quarts of milk can be purchased for 40 cents, the price paid for one quart of cream. The food value of the five quarts of milk exceeds many times the food value of the one quart of cream.

There are two ways of separating cream from milk, the gravity and centrifugal methods. In the first method the milk is allowed to stand for several

hours, and the fat, being lighter than the rest of the milk, rises to the top; the cream is then skimmed off, or the skimmed milk is removed through a faucet in the bottom of the tank in which the milk is contained. In the second method the cream is extracted in a separator by means of centrifugal force. The milk is allowed to flow into the rapidly revolving bowl of the separator, and the fat, being lighter than the rest of the milk, is forced toward the center of the bowl. As the revolving bowl becomes filled with milk the cream is forced out through the proper channel.

The statement has been made that separator cream is not so easily digested as is cream raised by gravity. The reason given for this is that the emulsion of fat is broken up by the separator. The truth of this statement has never been proved, and it is quite likely that separator cream is just as easily digested as is cream obtained by the gravity process.

SKIMMED MILK

Skimmed milk, or milk serum, is milk from which the fat has been removed. No process of separation is entirely complete and so a small percentage of fat remains in the skimmed milk. In skimmed milk from the separator the percentage of fat is very small, the aim of creamerymen being to get an average of not over .04 to .05 per cent. Small hand separators do not usually skim so closely as do large factory separators, but any separator should skim below .1 per cent fat.

The following table shows the percentage composition of skimmed milk from the separator:

	Percentage
Water	90.60
Fat	.10
Sugar	4.95
Casein	3.15
Albumen	.42
Ash	.78

The food value of skimmed milk is not always appreciated. By referring to the above table it will be seen that skimmed milk is rich in proteids (casein and albumen), which makes it a valuable food, especially for growing animals.

BUTTERMILK

Buttermilk is the material left after churning butter from cream. Its content depends somewhat on the percentage of fat lost during the process of churning, and frequently it is diluted with the water in which the butter is washed.

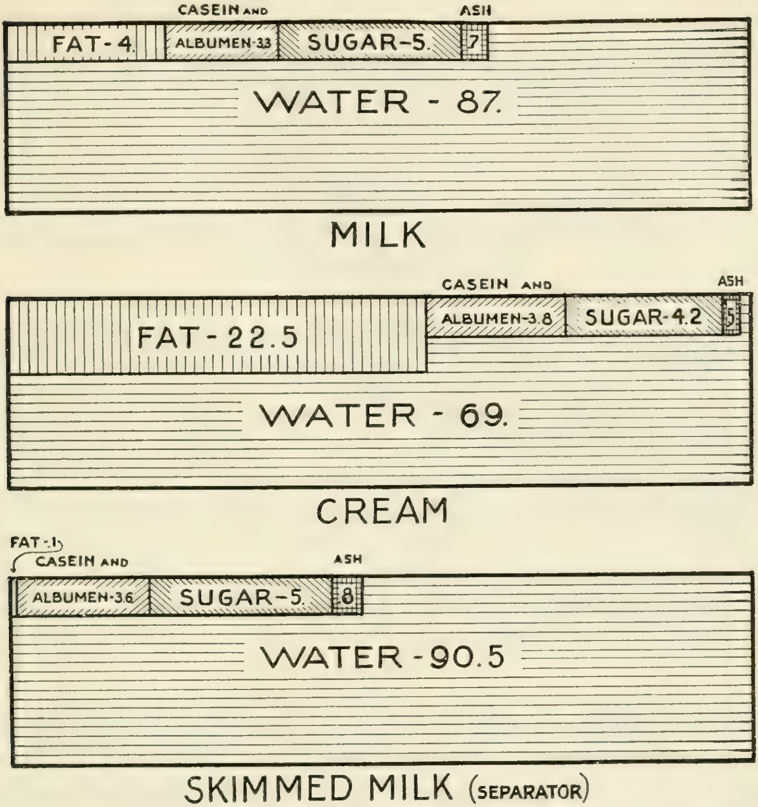


FIG. 28a.— *Chart illustrating the composition of milk, cream, and skimmed milk. Each rectangle represents 100 pounds, and the subdivisions show the quantities of the different constituents*

Richmond, quoting from Storch, gives the following percentage composition of buttermilk:

	Percentage
Water	90.93
Fat	.31
Sugar	4.58
Proteids (casein and albumen)	3.37
Ash	.81

The percentage of fat given is higher than it should be if the process of churning is properly carried out.

It may be seen from the table that buttermilk has a high food value; but it is especially valued as a food for the lactic acid that it contains. The amount of lactic acid in buttermilk varies, but is about .5 to .6 per cent. This acid is thought to have a stimulating effect on the digestive tract. The lactic-acid bacteria are said to overcome the putrefactive types and thus prevent putrefaction in the stomach and intestines.

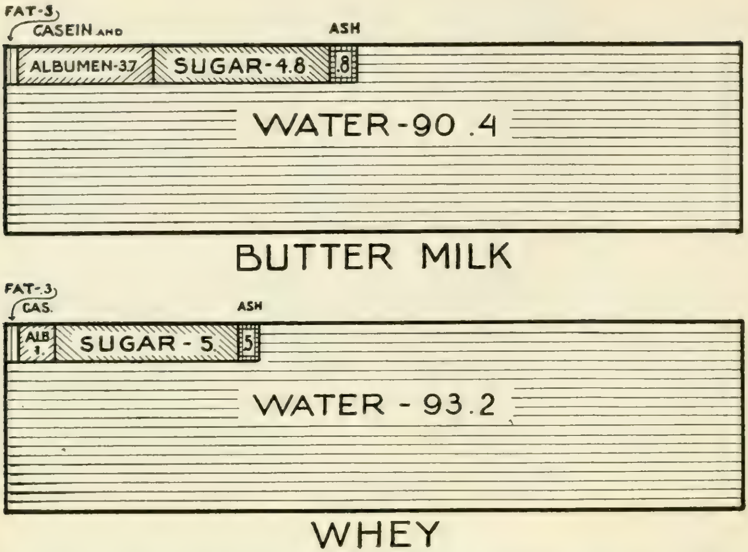


FIG. 28b.— *Chart illustrating the composition of buttermilk and whey. Each rectangle represents 100 pounds, and the subdivisions show the quantities of the different constituents*

WHEY

Whey is the fluid part of the milk that remains after cheese-making. It contains those ingredients of milk that are soluble — sugar, albumen, and part of the ash — and also more or less of the fat that escapes during the process of manufacture.

Van Slyke gives the following composition of whey:

	Percentage
Water	93.04
Fat	.36
Proteids (chiefly albumen)	.84
Sugar and salts	5.76

Whey is used chiefly as a food for animals. It is also used to some extent in modifying milk for infants and invalids. Containing, as it does, a high percentage of sugar and albumen, it is valuable in milk modification when the aim is to increase these constituents in the product.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 32 | ITHACA, N. Y. JANUARY 15, 1913 | DAIRYING SERIES No. 2

COMPOSITION OF MILK AND SOME OF ITS PRODUCTS

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1. Have you noticed any difference in the color of milk from different breeds of cows?

2. What difference in percentage of fat have you found in the milk of different cows in your herd?

3. Give the composition of normal milk, and the legal requirements of New York State for fat and for total solids.

4. What is the reason for the action of colostrum on boiling?

5. What are the usual differences in composition between colostrum and normal milk?

6. Have you ever noticed any difference in the hardness of butter made at different seasons of the year? What is the chief cause of this difference in hardness?

7. What two constituents of skimmed milk give to it its chief food value?

8. How much do you consider skimmed milk worth per 100 pounds, for feeding to young animals?

9. Is cream lighter or heavier than milk?

10. Why should a milk utensil, when being cleaned, be first rinsed in cold water?

11. Which of the constituents of milk are in solution?

Name..

Address..

Date..

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 34 | ITHACA, N. Y. FEBRUARY 15, 1913 | VEGETABLE-GARDENING SERIES No. 2

HOME-GARDEN PLANNING

ALBERT E. WILKINSON

There are various objects that home-gardeners may have in view when making their gardening plans. Sometimes the aim is to obtain a little

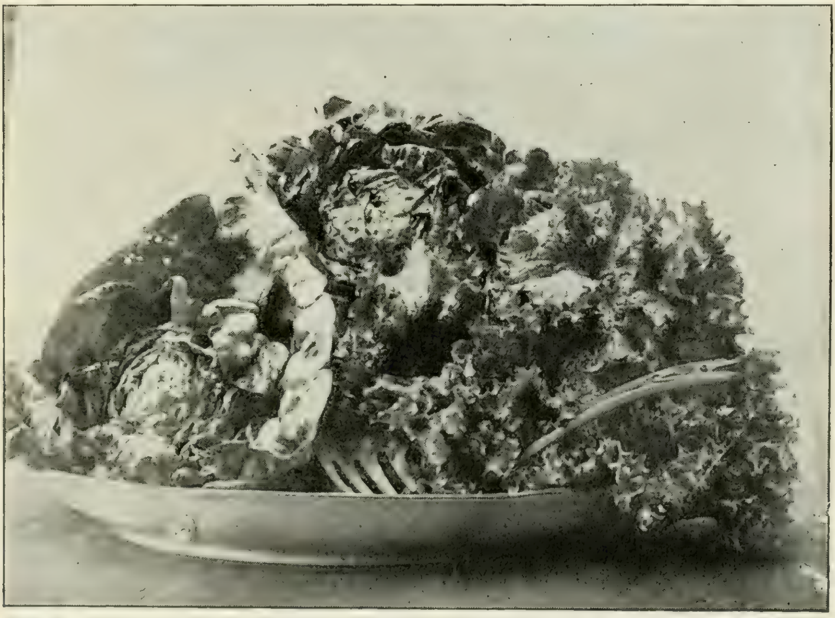

FIG. 29.— *A plate of crisp lettuce*

outdoor exercise. This is particularly true in the case of the man whose days are spent in an office. Another object may be to recall the old farm

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and the old garden to one who has left them and come to the city or the suburbs. Generally speaking, however, the main object is to obtain one of the best of foods — fresh vegetables. The last-named purpose results from the inability of the consumer to procure from the tradesman high-class produce fresh from the garden.

FIG. 30.— *Turban squash. Quality excellent*

The consumer-gardener, however, should not only have in mind the purpose of obtaining fresh vegetables; he should also plan to have a continuous supply of such vegetables, of as great a variety as possible. This depends entirely on careful garden planning and its successful execution.

A good time to begin planning the home vegetable garden is in winter, when most persons have more leisure than at other seasons. Many seed catalogues can be obtained early in the winter and from these a fairly satisfactory list of seeds can be made up. Some firms supply special vegetable seeds on which they have worked for several years; other houses are noted for certain varieties of vegetables, as a firm in Massachusetts for squashes and a Philadelphia firm for melons. The special work of such companies may be turned to advantage by the consumer.

FIG. 31.— *Half of a Hubbard squash. First quality*

FIG. 32.— *Marrow squash. Delicious quality*

In choosing varieties of corn, the seed for early strains should be bought from firms offering a variety that matures very early and is of fair to good

quality; this should be followed by corn maturing a little later, and so on to the very latest. Or one good variety may be planted at intervals; the

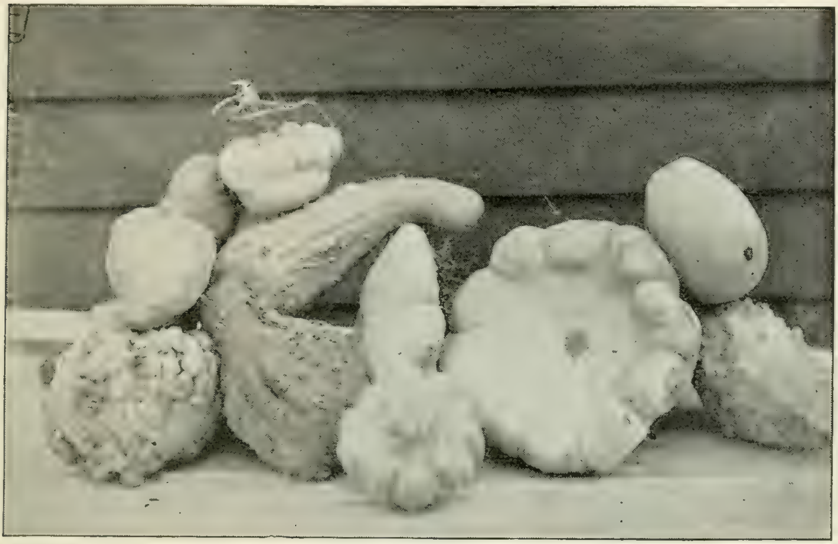

FIG. 33.— *Varieties of summer squash*

variety, whether white, black, or yellow, being chosen according to the preference of the consumer. The same is true of peas: extra early sorts should

FIG. 34.— *Pumpkins in variety*

be followed by early, medium, and late strains. Other vegetables may be chosen in like manner, according to the preference of the grower.

RECOMMENDED VARIETIES OF VEGETABLES

A list of vegetables is given below, with the names of varieties that, from the writer's experience, are the best to be recommended. Other varieties may be tried and found more desirable than those mentioned. Readers are advised to work out for themselves the varieties that will suit their individual tastes.

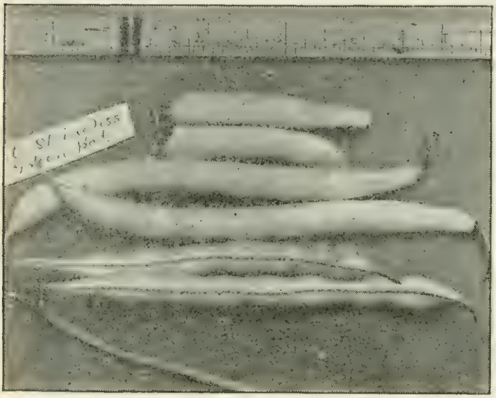

FIG. 35.— *Giant Stringless Green-Pod Valentine bean. An extra early stringless green bean*

Perennials

Artichokes.— Green Globe — which is cultivated for its flower heads, being cooked as is asparagus — is the variety most commonly desired. If the edible part wanted is the root, Jerusalem is the variety to use. Plant the latter variety 1 foot apart in the row, and the former 3 feet apart.

Asparagus.— Strong, well-developed, two-years-old roots of Argenteuil, Palmetto, or Conover's Colossal.

Horse-radish.— Sets of Bohemian.

Rhubarb.— Linnæus, Victoria.

Annuals

Beans, all dwarfs, green snap.— Six Weeks and Giant Stringless Green-Pod Valentine are very early.

Beans, all dwarfs, shell.— Dwarf Horticultural, The Goddard, and Bush Lima.

Beans, all dwarfs, yellow, or wax.— Wardwell's Kidney Wax, Golden Wax, Stringless Refugee Wax, and others are good.

FIG. 36.— *Wardwell's Kidney Wax bean. Early-maturing, perfectly stringless, quality of the best*

Beets, early.— Crosby Egyptian, Early Eclipse. The former is very desirable.

Beets, late.— Edmand's Blood for a standard, Detroit Dark Red for a deep, blood-red color.

Brussels sprouts.— Long Island and Danish are very good.

Cabbage, early.— Early Jersey Wakefield, Early Erfurt.

Cabbage, late.— All Seasons, Danish Ball Head, Volga, Drumhead. Extra Choice Drumhead Savoy is a very good fancy cabbage.

Cabbage, red.—Red Dutch, Red Rock, Red Erfurt.

Carrots, one-half long.— Danvers One Half Long, Chantenay One Half Long, Oxheart.

Carrots, long.— Danvers, Long Orange.

Cauliflower.— Snowball, Erfurt.

Celeriac.— Apple Shape.

Celery, early.— Golden Self-blanching.

Celery, late.— Self-blanching, Winter Queen, Kalamazoo, Boston Market, Giant Pascal.

Chard, Swiss.— Order by name only, or variety Giant Lucullus.

Corn, early.— Metropolitan, Adam's, Cory, Aristocrat.

Corn, mid-season.— Quincy Market, Golden Bantam, Black Mexican, Country Gentleman.

Corn, late.— Stowell's Evergreen, some of mid-season varieties planted later.

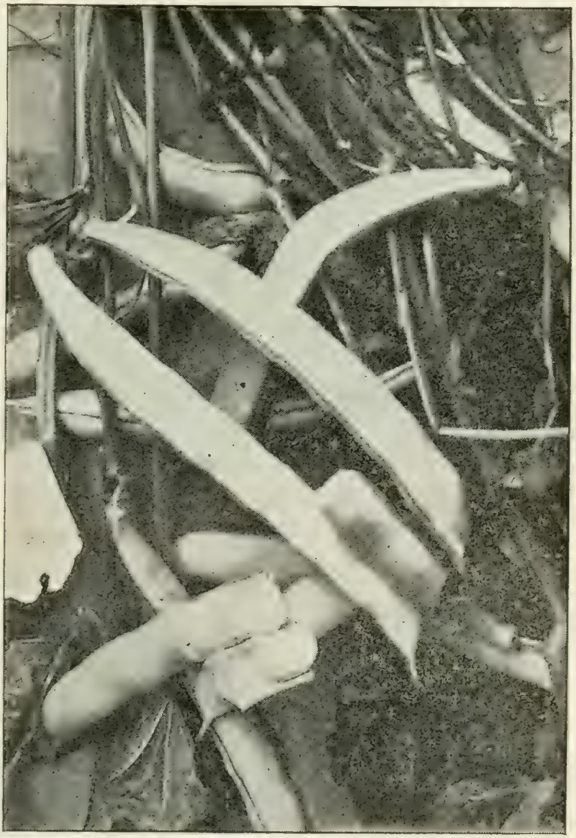

FIG. 37.— *Improved Golden Wax bean. A choice stringless wax bean*

Cucumbers.— Arlington White Spine, Davis, Cool and Crisp, Fordhook.

Eggplant, early.— Black Beauty, New York or Long Island Improved, Black Pekin.

Endive.— White Curled, Batavian.

Kohl-rabi.— Early White or Purple Vienna.

Leek.— Carentar, American Flag.

Lettuce.—
For forcing in hotbed, Hittinger's Forcing.
Outside growing, *Light yellow.*— Salamander.
Yellowish green.— Big Boston, All Seasons, Cos White Paris.
Red or *brown.*— Mignonette, Crisp as Ice.

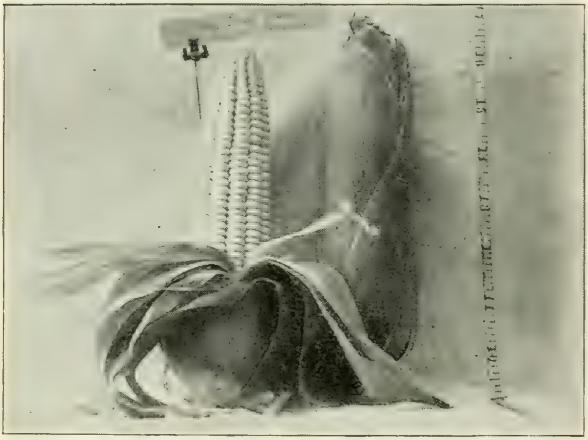

FIG. 38.— *Extra Early Adams sweet corn. One of the best of its class in size, shape, and quality*

Muskmelons.— Rocky Ford, Jenny Lind, Gem, Miller Cream, Hackensack.

Onions, yellow.—Danvers, Southport, Prizetaker, Australian Brown.

Onions, red.— Wethersfield, Danvers, Southport.

Onions, white.— Southport and sets.

Onions, top.— Plant in the fall, harvest in the spring.

Parsnips. — Abbott's Hollow Crown.

Peas, early, dwarf.— Surprise, Alaska, Gem, Eureka.

Peas, mid-season, dwarf.— Excelsior, Thomas Laxton, American Wonder, Early Morn, Admiral Dewey, Abundance, Gradus, McLean's.

Peas, late, dwarf.— Telephone, Dwarf Champion, Dwarf White Sugar.

Peppers.— Chinese Giant, Ruby King, Red Cayenne.

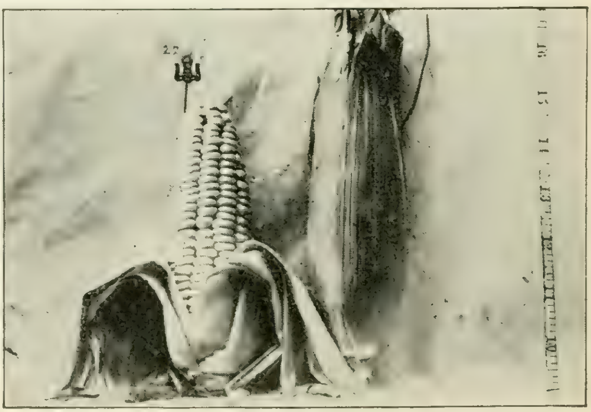

FIG. 39.— *Extra Early Cory sweet corn. Very good for a "first of all"*

Potatoes, early.— Bliss Triumph, Early Rose, Early Northern, Early Ohio.

Potatoes, late.— Carmen 3, Rural New Yorker, Sir Walter Raleigh, Irish Cobbler, Gold Coin, Green Mountain, White Flyer.

Pumpkins.— Sugar, Quaker, Cashaw.

Radish, early.— Cardinal Globe, Crimson Giant, French Breakfast.

Radish, summer.— Chartier, Icicle.

Radish, winter.— Long Black Spanish, Celestial, Long White Spanish, Scarlet China.

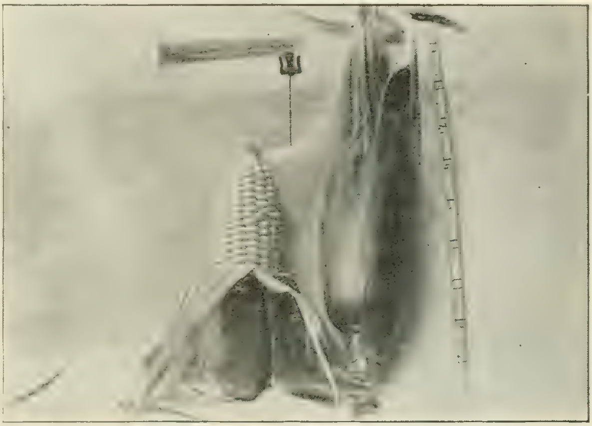

FIG. 40.— *Early Crosby sweet corn. An excellent second early*

Salsify.— Sandwich Island, Long White.

Spinach.— Giant Thick Leaf, Long Season, New Zealand.

Squash, early.— White Bush, Crook Neck.

Squash, late.—Hubbard, Faxon, Marrow, Delicious.

Tomatoes.— Earliana, Bonnie Best, Chalk's Jewel, Model, Stone, Champion.

Turnips, early.— White Milan, Purple Top Milan, Snowball.

Turnips, late.— American Rutabaga, White Rock, White Egg.

ARRANGEMENT OF GARDEN

The question now arises, how to arrange the vegetables in the above list so as to have all or most of them in the garden. Three plans, to suit three classes of growers, are herewith presented and fully discussed.

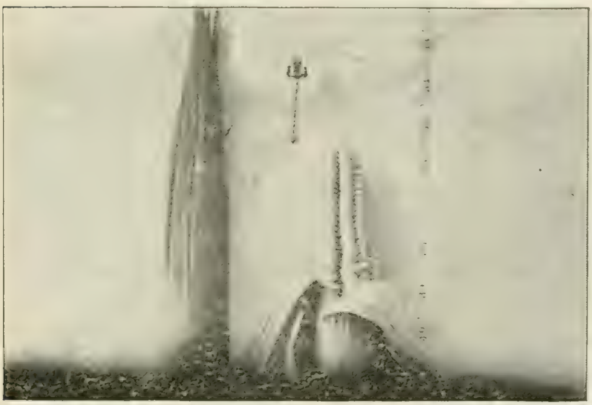

FIG. 41.— *Black Mexican sweet corn. By reputation the sweetest of all*

Plan 1

Plan 1 is that of a garden 25 by 35 feet in size. This is the area that is available in many suburban and city back yards, and it is a considerable task to plan for so many varieties of vegetables with so small a garden. However, by the interplanting of crops and by succession cropping —

GARDEN 25 BY 35 FEET

Vegetable	Number of row	Amount of seed	Cost of seed	Planting: Time	Planting: Method	Planting: Depth (inches)	Planting: Distance apart of seed or plant (inches)	Thinning: Time	Thinning: Space between plants (inches)	Thinning: Method of disposal	Harvesting: First	Harvesting: Final	Remarks
Beans, green snap	24	1 pt.	$0.20	May 1-15	Drills	1	1 to 2	June 15	3 to 4	Destroy	July 1-15	Sept. 1	
Beans, wax snap	22	1 pt.	.20	May 1-15	Drills	1	1 to 2	June 15	3 to 4	Destroy	July 1-15	Sept. 1	
Beans, shell	26	1 pt.	.15	May 1-15	Drills	1	1 to 2	June 15	3 to 4	Destroy	Aug. 1	Sept. 30	
Beets, early	½ of 19	1 pkg.	.05	Apr. 15	Drills	½ to ¾	¼ to ½	June 15-30	3	Greens	June 15-30	Aug. 1	
Beets, late	½ of 19	1 pkg.	.05	May 15	Drills	½ to ¾	¼ to ½	July 1-15	4	Greens	July 15-30	Oct. 15	Winter
Brussels sprouts	½ of 12	1 pkg.	.10	Mar. 15	Hotbed	½	12	....	....	....	Aug. 1	Oct. 1-15	
Cabbage, early	¾ of 9	1 pkg.	.10	Mar. 15	Hotbed	....	18	....	....	....	July 15-30	Sept. 1-15	
Cabbage, late	32, 33	1 pkg.	.05	May 15	Hotbed	....	24	....	....	....	Aug. 1-15	Nov. 1	Winter
Cabbage, red	¼ of 9	1 pkg.	.05	Apr. 15	Hotbed	....	24	....	....	....	July 30	Oct. 30	
Carrots, ½ long	½ of 1	1 pkg.	.05	Apr. 15-30	Drills	½	¼ to ½	June 1-15	2	Destroy	July 1-15	Aug. 15	
Carrots, long	½ of 1	1 pkg.	.05	Apr. 15-30	Drills	½	¼ to ½	June 1-15	3	Destroy	July 15-30	Oct. 1-30	Winter
Cauliflower	½ of 12	1 pkg.	.20	Apr. 15	Hotbed	....	18	....	....	....	July 1-15	Oct. 15	
Celery, early	34	1 pkg.	.10	Mar. 15	Hotbed	....	4	....	....	....	June 1-15	July 15	
Celery, late	27, 28, 29, 30, 31	1 pkg.	.10	May 1	Hotbed	....	5	....	....	....	Sept. 15	Nov. 15	Winter
Chard, Swiss	3	1 pkg.	.05	Apr. 15	Drills	½ to ¾	¼ to ½	June 15	12	Greens	June 15-30	July 15	
Corn, early	7	½ pt.	.10	May 15	Hills	1	3	July 1	Hills 18	Destroy	July 30	Sept. 1	
Corn, mid-season	4	½ pt.	.10	June 1	Hills	1	3	July 15	Hills 18	Destroy	Aug. 15	Sept. 15	
Corn, late	2	½ pt.	.10	June 15	Hills	1	3	July 30	Hills 18	Destroy	Sept. 1-15	Sept. 30	
Cucumbers	35	1 pkg.	.05	May 15	Drills	½ to ¾	1	July 1-15	6	Destroy	Aug. 15-30	Sept. 15-30	
Endive	8	1 pkg.	.05	May 1	Drills	½	¼	June 15	12	Greens	July 15	July 30	
Kohl-rabi	½ of 18	1 pkg.	.05	Mar. 15	Hotbed	....	6	....	....	....	May 30	June 15-30	
Leek	16, 17	2 pkgs.	.10	Apr. 1	Hotbed	....	3	....	....	....	June 1-15	July 1-15	
Lettuce	Part of 36	2 pkgs.	.20	Apr. 1 on	Hotbed	¼ to ½	10	....	....	....	May 20-30	All seasons	Plant wherever space allows
Onions	10, 11, 13, 1[illegible]	3 pkgs.	.30	Apr. 7	Hotbed	....	3	....	....	....	June 1-15	Aug. 15-30	Plant wherever space allows
Parsnips	½ of 20	1 pkg.	.05	Apr. 15	Drills	¼ to ½	¼ to ½	June 1-15	4	Destroy	Sept. 1-15	Oct. 30	Winter
Peas, early	27, 28	1 qt.	.65	Apr. 1-15	Drills	1½ to 2	Close	....	....	....	June 15-20	July 1-10	
Peas, mid-season	29, 30, 31	1½ qts.	1.00	Apr. 15-30	Drills	1½ to 2	Close	....	....	....	June 30	July 15-20	
Peas, late	32, 33	1 qt.	.45	May 1-15	Drills	1½ to 2	Close	....	....	....	July 15	Aug. 1-10	
Radishes, early	Part of 12	2 pkgs.	.10	Apr. 1 on	Drills	½	½	1 week after planting	1 to 1½	Destroy	May 1	All seasons	Plant wherever space allows
Radishes, winter	36	2 pkgs.	.10	June 1	Drills	½	½	June 15-20	6	Destroy	Sept. 1	Oct. 15-30	Winter
Salsify	½ of 20	1 pkg.	.10	Apr. 15-30	Drills	½	½	June 1-15	4	Destroy	Sept. 1-15	Oct. 30	Winter
Spinach	5, 6, 21, 23, 25	¼ lb.	.25	Apr. 1-30	Drills	½	½	May 30	3	Greens	May 15-30	June 30	Plant wherever space allows
Squash, early	¼ of 4	1 pkg.	.05	May 1	Corn hills	¾	Corn hills	....	....	....	June 15-30	July 15	
Squash, late	¾ of 4	1 pkg.	.10	May 15	Corn hills	¾	Corn hills	....	....	....	Sept. 1-15	Oct. 15	Winter
Tomatoes	15	1 pkg.	.05	Apr. 1	Hotbed	....	36	....	....	....	June 15-30	Sept. 15-30	
Turnips, early	½ of 18	1 pkg.	.05	Apr. 1-15	Drills	½	½	May 15-30	6	Destroy	June 1-15	Aug. 1	
Turnips, late	34	2 pkgs.	.10	May 15	Drills	½	½	June 15-30	10	Destroy	Aug. 15	Oct. 1-15	Winter
			$5.60										

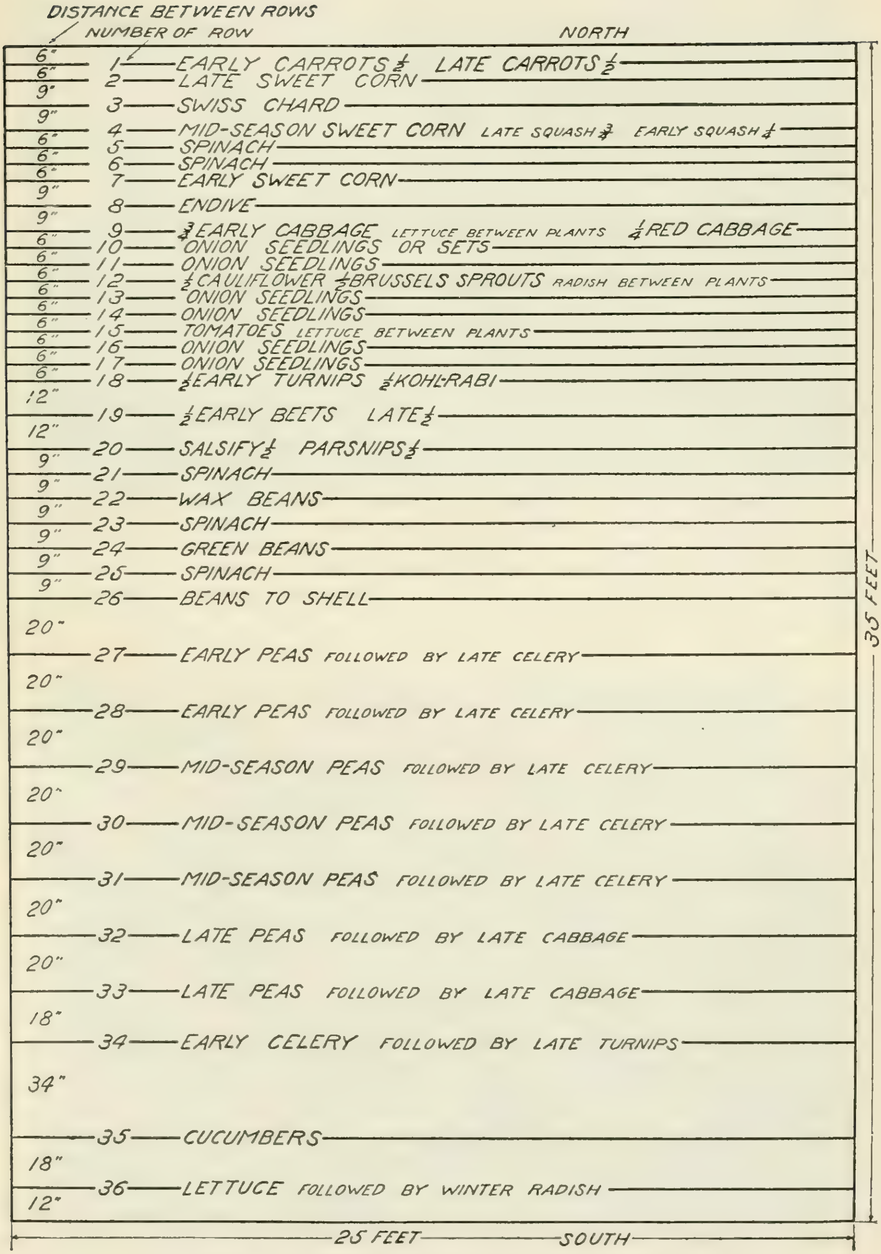

FIG. 42.— *Plan for garden 25 by 35 feet in size*

two of the principal intensive methods for vegetable production — it is possible to include most of the annuals in this plot. The perennials are omitted, the main object being to produce the maximum amount of vegetables in the minimum space.

One well-built hotbed, constructed and managed as described in Lesson No. 30 of the Cornell Reading-Course for the Farm, would aid this small garden materially as plants could be raised for later transplanting. Such plants as brussels sprouts, early, mid-season, and late cabbage, cauliflower, kohl-rabi, leek, lettuce, onion, tomatoes, and celery could be produced and made ready for outside transplanting on the dates when they would be required. It would thus be possible not only to save in the expense of buying plants but also to have better plants just when the grower wants them. It would be possible also to obtain larger and better produce from the garden, as many times the plants could be held back or pushed forward so as to accommodate the unfavorable or favorable conditions prevailing.

Following is a list of seeds, together with the place where they should be planted and the proper time for planting. This list should be taken only as a guide; no hard and fast rules can be laid down, for each plot must be governed by local conditions of climate and soil. The tables may therefore be too early for some growers and too late for others.

Vegetable seeds planted in a hotbed:

March 15

Early brussels sprouts	Early celery
Early cabbage	Early kohl-rabi

April 1

Leek	Tomatoes
Onions	Lettuce

April 15

Red cabbage	Cauliflower

May 1

Late celery	Lettuce

May 15

Late cabbage	Late kohl-rabi
Late brussels sprouts	Late cauliflower

FIG. 43.— *Salamander. The choicest light yellow, large, solid-head variety*

FIG. 44.— *Big Boston lettuce. The solid, light green head of quality*

Time for planting seeds or transplanting plants in the garden:

April 1–15

Early peas (seeds)

April 15 (all seeds)

Early beets	Radishes
Swiss chard	Parsnips
Early carrots	Salsify
Mid-season peas	Early turnips

April 15–30 (all plants)

Early brussels sprouts	Early kohl-rabi
Early cabbage	

May 1–10

Early corn (seeds)	Early celery (plants)
Lettuce (plants)	Leek (plants)
Endive (seeds)	Onions (plants)
Radishes (seeds)	

May 10–20 (all seeds)

Beans, green	Cucumbers
Beans, wax	Late peas
Late carrots	Early squash

May 20–30

Beans, shell (seeds)	Cauliflower (plants)
Late beets (seeds)	Red cabbage (plants)
Late squash (seeds)	Tomatoes (plants)
Late turnips (seeds)	

June 1–10 (all seeds)

Mid-season corn	Winter radishes
Lettuce	

June 10–20

Late corn (seeds)	Lettuce (seeds)
Late celery (plants)	

June 30

Late cabbage (plants)	Late kohl-rabi (plants)
Late cauliflower (plants)	Lettuce } in vacant places
Late brussels sprouts (plants)	Radishes } (seeds)

By reference to the table on page 80 other points can be ascertained, such as the number of the row in which a vegetable may be planted, the amount of seed to order — quart, pint, or package — the cost of the seed, and like matters.

FIG. 45.— *Ripe tomatoes*

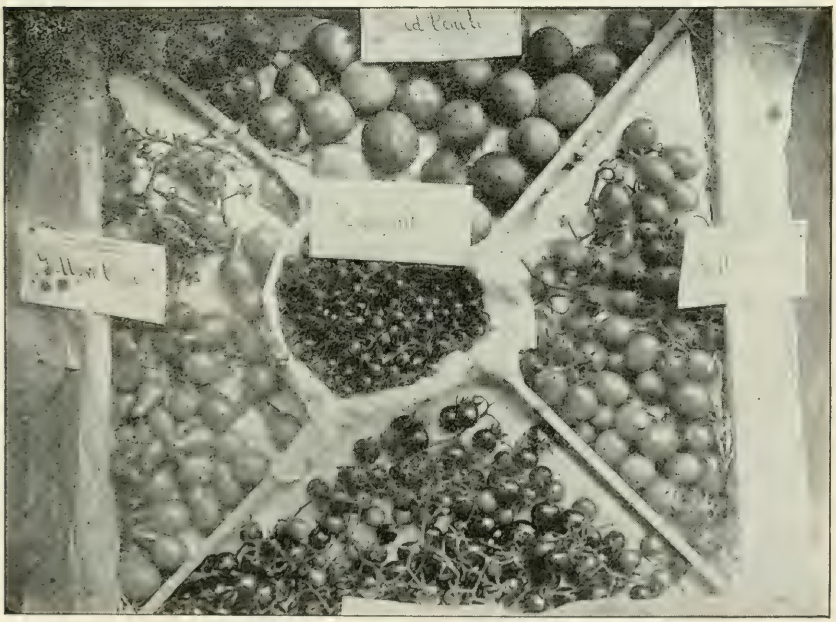

FIG. 46.— *Preserving tomatoes: Yellow Pear, Red Peach, Currant, Cherry, and Yellow Plum*

FIG. 47.— *Tomato trellises: a garden convenience*

FIG. 48.— *Artichokes: Cardoon at left, bur at right*

It will be well to plan for tools and fertilizing material required for the garden. Four corner stakes are needed; two other stakes, with a garden line such as cod line or any stout cord about 40 feet long, will aid in keeping the rows straight. The cost of the various articles needed is as follows:

FIG. 49.— *First-class celery*

Line	$0.10
Trowel	.10
Spading fork or spade	.75
Rake	.65
Onion hoe	.40
Hand weeder	.10

Miscellaneous pieces of wood for marking rows, stakes for tomatoes, and the like, will be found useful.

A wheeled hoe, costing $4.50 with all attachments, would be of service but is not necessary.

A cord of well-rotted stable manure should be provided.

FIG. 50.— *New York Purple eggplant*

Plan 2

The garden considered in the second plan is nearly twice as large as that in the first, being 50 by 60 feet. A garden of this size is often found in the country village, where the inhabitants have more land to devote to the raising of vegetables. Sometimes the dweller in a suburb rents a piece of ground near his garden and thus increases his plot to the size of that treated in plan 2, or even larger. On the larger area a greater number of varieties can be grown, as well as more individuals of each variety; the three aims in making a home garden should be borne in mind, however — a constant supply of vegetables, good quality, and variety.

Vegetable	Number of row	Amount of seed	Cost of seed	Planting			
				Time	Method	Depth (inches)	Distance apart of seed (inches)
Artichokes	Bed	4 roots	$0.50	. . . .	. . . .	. . . .	. . . .
Asparagus	Bed	50 roots	.50	. . . .	. . . .	. . . .	. . . .
Beans, green	½ of 24, ½ of 27	1 qt.	.35	May 1–15	Drills	1	1 to 2
Beans, wax	½ of 24, ½ of 27	1 qt.	.35	May 1–15	Drills	1	1 to 2
Beans, shell	29	1 qt.	.35	May 1–15	Drills	1	1 to 2
Beets, early	12	1 oz.	.15	Apr. 15	Drills	½ to ¾	¼ to ½
Beets, late	17	1 oz.	.15	May 15	Drills	½ to ¾	¼ to ½
Brussels sprouts	½ of 13	1 pkg.	.10	Mar. 15	Hotbed	½	½
Cabbage, early	8	1 pkg.	.10	Mar. 15	Hotbed	½	¼ to ½
Cabbage, late	25	1 pkg.	.05	May 15	Hotbed	½	¼ to ½
Cabbage, red or Savoy	25	1 pkg.	.05	Apr. 15	Hotbed	½	¼ to ½
Carrots, ½ long	¼ of 31	1 pkg.	.05	Apr. 15–30	Drills	¼ to ½	¼ to ½
Carrots, long	¾ of 31	1 oz.	.20	Apr. 30	Drills	¼ to ½	¼ to ½
Cauliflower	½ of 13	1 pkg.	.20	Apr. 15	Hotbed	½	¼ to ½
Celeriac	½ of 33	1 pkg.	.05	May 1	Hotbed	¼ or less	Thick
Celery, early	26, 28	1 pkg.	.10	Mar. 15	Hotbed	¼ or less	Thick
Celery, late	21, 23	1 pkg.	.10	May 1	Hotbed	¼ or less	Thick
Chard, Swiss	½ of 36	1 pkg.	.10	Apr. 15	Drills	½ to ¾	¼ to ½
Corn, early	1	1 pt.	.20	May 15	Hills	1	3
Corn, mid-season	3	1 pt.	.15	June 1	Hills	1	3
Corn, late	5	1 pt.	.15	June 15	Hills	1	3
Cucumbers	15	1 pkg.	.10	May 15	Drills	½ to ¾	1
Eggplant	½ of 11	1 pkg.	.10	Apr. 15	Hotbed	½	½
Endive	2, ½ of 36	1 pkg.	.05	May 1	Drills	½	½
Horse-radish	Bed	12 roots	.20	. . . .	. . . .	. . . .	. . . .
Kohl-rabi	½ of 33	1 pkg.	.05	Mar. 15	Hotbed	½	½
Leek	Between pl'ts	2 pkgs.	.10	Apr. 1	Hotbed	½	¼ to ½
Lettuce	Between pl'ts	4 pkgs.	.40	Apr.–Sept.	Hotbed and field	¼ to ½	¼ to ½
Muskmelons	Bed	2 pkgs.	.10	May 15	Drills	½ to ¾	1
Onions	6, 10, 39	6 pkgs.	.60	Apr. 1	Hotbed	½	¼ to ½
Parsnips	½ of 30	2 pkgs.	.10	Apr. 15	Drills	¼ to ½	¼ to ½
Peas, early	20, 22	2 qts.	1.30	Apr. 1	Drills	1½ to 2	Thick
Peas, late	19	1 qt.	.65	May 1	Drills	1½ to 2	Thick
Peppers	½ of 11	1 pkg.	.05	Apr. 1	Hotbed	½	½
Potatoes, early	14, 16	1 pk.	.75	May 1	Drills	4	10
Potatoes, late	34, 35, 38	1 pk.	.70	May 15	Drills	4	10
Pumpkins	3, in corn	2 pkgs.	.10	May 15	Corn hills	¾ to 1	2 or 3 in hill
Radishes, early	Between cucumber pl'ts	1 oz.	.15	Apr.–Aug.	Drills	½	¼ to ½
Radishes, winter	Bed	1 pkg.	.05	June 1	Drills	½	½
Rhubarb	Bed	4 roots	.40	. . . .	. . . .	. . . .	. . . .
Salsify	½ of 30	2 pkgs.	.10	Apr. 15	Drills	½	½
Spinach	18 late, 4, and between pl'ts	½ lb.	.25	Apr. 1 on	Drills	½	¼ to ½
Squash, early	3, in hills	2 pkgs.	.10	May 1	Corn hills	¾	3 or 4 in hill
Squash, late	3, in hills	3 pkgs.	.15	May 15	Corn hills	¾	3 or 4 in hill
Tomatoes	7, 9	3 pkgs.	.15	Apr. 1	Hotbed	¼ to ½	¼ to ½
Turnips, early	½ of 32	1 pkg.	.05	Apr. 15	Drills	½	¼ to ½
Turnips, late	½ of 32	2 pkgs.	.10	May 15	Drills	½	¼ to ½
			$10.80				

BY 60 FEET

Transplanting		Thinning			Harvesting		Remarks
Time	Distance apart of plants (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	
Apr. 15	36				Sept. 30	Oct. 15–30	Or later
Apr. 15	12				2 years after planting	July 1–4	
		June 15	3 to 4	Destroy	July 1–15	Sept. 1–15	
		June 15	3 to 4	Destroy	July 1–15	Sept. 1–15	
		June 15	3 to 4	Destroy	Aug. 1–15	Sept. 30	
		June 15	3	Greens	June 15–30	Aug. 1	
		July 1–15	4	Greens	July 15–30	Oct. 15	Winter
Apr. 15–30	18				Aug. 1–15	Oct. 15	
Apr. 15–30	18				July 1–15	Sept. 1	
June 15–30	24				Aug. 15–30	Nov. 1	Winter
May 20–30	24				July 30	Oct. 30	Winter
		June 1–15	2	Destroy	July 1–15	Aug. 1–15	
		June 1–15	3	Destroy	July 15–30	Oct. 1–15	Winter
May 20–30	18				July 1–15	Oct. 15	
June 10–20	10 to 12				Sept. 15	Nov. 1	Winter
May 1–10	4				June 1–15	July 15	
June 10–20	5 to 6				Sept. 15	Nov. 14	Winter
		June 15	12	Salads, greens	June 15–30	July 15	
		July 1	Hills 18	Destroy	July 30	Sept. 1	
		July 15	Hills 18	Destroy	Aug. 15–30	Sept. 15	
		July 30	Hills 18	Destroy	Sept. 1–15	Sept. 30	
		July 1–15	6	Destroy	Aug. 15–30	Sept. 15–30	
May 20–30	15				Sept. 1	Sept. 15	
		June 15	12	Greens	July 15	July 30–Aug. 15	
Apr. 15–30	12				Nov. and next spring		Winter
Apr. 15–30	9				May 30	June 15–30	
May 1–10	3				June 1	July 15	
Apr. – Aug.	10				May 20–30	All seasons	
		June 15	6	Destroy	Aug. 15–30	Oct. 15	
Apr. 1–30	3				June 1–15	Aug. 15–30	
		June 1–15	4	Destroy	Sept. 1	Oct. 30	Winter
					June 15–20	July 1	
					June 30	July 15–30	
May 20–30	12				Aug. 15	Oct. 1–15	
					June 15–30	Aug. 1	
					Aug. 15–30	Oct. 15	
		June 15	2 in hill	Destroy	Oct. 1	Oct. 15	Winter
		10 days after pl't'g		Destroy	May 1	All seasons	
		June 15	6	Destroy	Sept. 1	Oct. 15	Winter
Apr. 15	36				May 15	July 15	
		June 1–15	4	Destroy	Sept. 1	Oct. 30	Or in spring
		May 30	3	Greens	May 15–30	June 30	Or later
		June 1	2 in hill	Destroy	June 15	July 15	
		June 15	2 in hill	Destroy	Sept. 1	Oct. 15	Winter
May 20–30	36				June 15–30	Sept. 15–30	
		May 15	6	Destroy	June 1–15	Aug. 1	
		June 15	10 to 12 in hill	Destroy	Aug. 15	Oct. 1–15	Winter

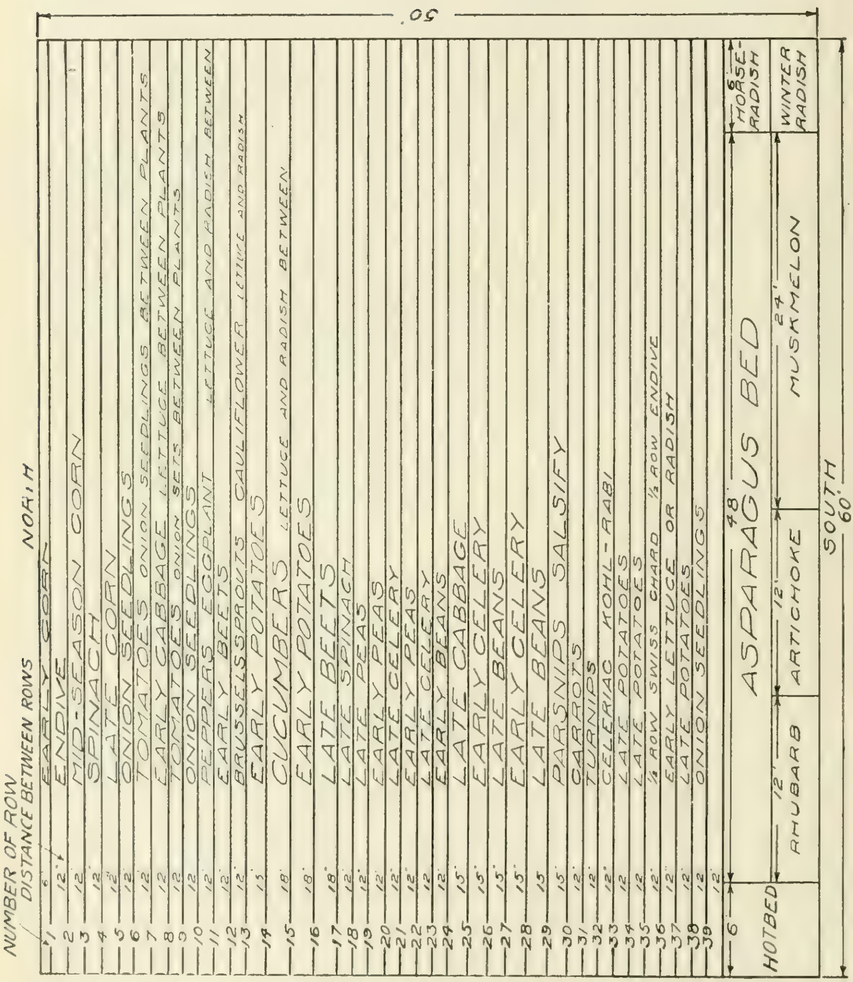

FIG. 51.— *Plan for garden 50 by 60 feet in size*

The tools required for such a garden are the same as those listed under plan 1, except that the garden line should be twice the length of that required for the latter, and two hotbed sashes, with boards, manure, and other material for a pit, should be provided. It is often possible to have the garden plowed with horses instead of dug by hand, and some harrowing with horses can be done.

It would be to the advantage of the gardener to procure a wheeled hand-planter and a wheeled combination tool. These are not necessary for a garden of this size, but they would save time in planting and cultivating.

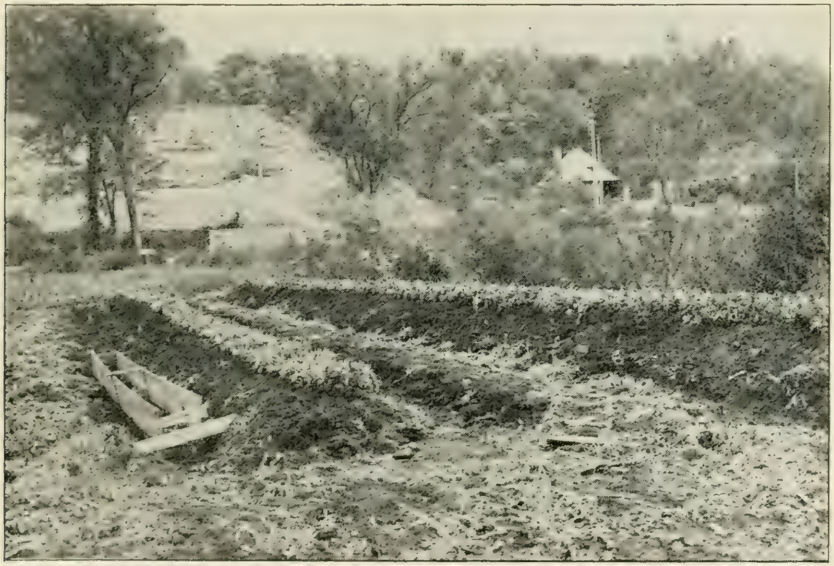

FIG. 52.—*Celery dirt-banked, or blanching. At the left a board blancher*

About two cords of well-rotted stable manure are needed for a garden of this size, and fifty to one hundred pounds of a high-grade commercial fertilizer.

Plan 3

In a large garden about 110 by 200 feet in size, such as is used by the farmer and the large landowner, the rows should run the long way so as to economize time in cultivation. The garden must be arranged in such a manner that practically all cultivation can be done with horse power, owing to the fact that the average farmer can spare but little time for the more intensive methods of gardening. It might, however, be to the farmer's interest to give a little more time to better gardening, considering that probably twenty-five to forty per cent of the living of his family is derived from the garden. The garden does not demand much time; half an hour to an hour a day of thorough work will keep it in good condition after the preparation and planting are finished.

Vegetable	Number of row	Amount of seed	Cost of seed	Planting			
				Time	Method	Depth (inches)	Distance apart of seed (inches)
Artichokes, bur	¼ of 32	18 roots	$2.25	....	....	......	....
Artichokes, Jerusalem	¼ of 32	48 roots or 1 qt.	.25	....	....	......	....
Asparagus	33	200 two-yr. roots	2.00	....	....	......	....
Beans, green	½ of 7	1 qt.	.35	May 1–15	Drills	1	1 to 2
Beans, wax	½ of 7	1 qt.	.40	May 1–15	Drills	1	1 to 2
Beans, pole	31	1 qt.	.35	May 1–15	Hills, 6 to 8 seeds	1	1 to 2
Beets, early	8	¼ lb.	.50	Apr. 15	Drills	½ to ¾	¼ to ½
Beets, late	4, 5	½ lb.	.75	July 15–30	Drills	½ to ¾	¼ to ½
Brussels sprouts	13	1 pkg.	.10	Mar. 15	Hotbed	½	½
Cabbage, early	19	1 pkg.	.10	Mar. 15	Hotbed	½	¼ to ½
Cabbage, late	½ of 27	1 pkg.	.05	May 15	Cold-frames	½	¼ to ½
Cabbage, red	¼ of 27	1 pkg.	.05	Apr. 15	Hotbed	½	¼ to ½
Cabbage, Savoy	¼ of 27	1 pkg.	.05	Apr. 15	Hotbed	½	¼ to ½
Carrots, ½ long	¼ of 10	1 oz.	.25	Apr. 15–30	Drills	¼ to ½	¼ to ½
Carrots, long	¾ of 10	2 oz.	.40	Apr. 30	Drills	¼ to ½	¼ to ½
Cauliflower	¾ of 8	1 pkg.	.20	Apr. 15 and later	Hotbed	½	¼ to ½
Celeriac	½ of 9	1 pkg.	.05	May 1	Hotbed	¼ or less	Thick
Celery, early	20	1 pkg.	.10	Mar. 15	Hotbed	¼ or less	Thick
Celery, late	18, 19	1 pkg.	.10	May 1	Hotbed	¼ or less	Thick
Chard, Swiss	Herb bed	1 pkg.	.10	Apr. 15	Drills	½ to ¾	¼ to ½
Corn, early	27	1 pt.	.20	May 15 or earlier	Hills	1	3
Corn, mid-season	28, 29	1 qt.	.30	June 1	Hills 18 in. apart	1	3
Corn, late	30	1 pt.	.15	June 15	Hills 24 in. apart	1	3
Cucumbers	⅓ of 22	1 pkg.	.10	May 15	Drills	½ to ¾	1
Eggplant	½ of 16	1 pkg.	.10	Apr. 15	Hotbed	½	½
Endive	½ of 9	1 pkg.	.05	July 1	Drills	½	½
Horse-radish	¼ of 32	50 roots	.50	....	....	......	....
Kohl-rabi	¼ of 8	1 pkg.	.05	Apr. 15	Hotbed	½	½
Leek	Between tomatoes	2 pkgs.	.10	Apr. 1	Hotbed	½	¼ to ½
Lettuce	In melons and elsewhere	6 pkgs.	.50	Apr.–Sept.	Hotbed and field	¼ to ½	¼ to ½
Muskmelons	Bed	3 pkgs.	.40	May 15	Hills, plow	½ to ¾	1
Okra	¼ of 16	1 pkg.	.05	Mar. 15	Hotbed	½ to ¾	¼ to ½
Onions	13, 14, 15, and between	3 oz.	.45	Apr. 1 or later	Hotbed and outside	½	¼ to ½
Parsnips	11	2 oz.	.25	Apr. 15	Drills	¼ to ½	¼ to ½
Peas, early	1	2 qts.	1.30	Apr. 1	Drills	1½ to 2	Thick
Peas, mid-season	2, 3, 4, 5	1 pk.	4.00	Apr. 15	Drills	1½ to 2	Thick
Peas, late	6	2 qts.	1.00	May 30	Drills	1½ to 2	Thick
Peppers	¼ of 16	1 pkg.	.05	Apr. 1	Hotbed	½	½
Potatoes, early	21, 23	4 pks.	2.00	May 1	Drills	4	10
Potatoes, late	24, 25, 26	1½ bu.	3.00	May 15	Drills	4	10
Pumpkins	In sweet corn	2 oz.	.20	May 15	Corn hills	¾ to 1	2 or 3 in every third corn hill
Radishes, early	In melons and vacant places	3 oz. in pkgs.	.30	Apr.–Aug.	Drills and hotbed	½	¼ to ½
Radishes, winter	Herb bed	2 pkgs.	.10	June 1	Drills	½	½
Rhubarb	¼ of 32	16 roots	2.50	....	....	......	....
Saisify	12	¼ lb.	.50	Apr. 15	Drills	½	½
Spinach	Early 6, 18, late anywhere	½ lb.	.25	Apr. 1 on	Drills	½	¼ to ½
Squash, early	⅓ of 22	2 pkgs.	.10	May 1–15	Hills, 6 to 8 seeds	¾	3 to 6
Squash, late	2, ⅓ of 22	¼ lb.	.40	May 15–July 1	Hills	¾	3 to 4
Tomatoes	17	3 pkgs.	.25	Apr. 1	Hotbed	¼ to ½	¼ to ½
Turnips, early	9	2 oz.	.20	Apr. 15	Drills	½	¼ to ½
			$27.75				

BY 200 FEET

Transplanting		Thinning			Harvesting		
Time	Distance apart of plants (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	Remarks
Apr. 15	36	....	....	......	Sept. 30	Oct. 30, Nov. 30	
Apr. 15	12	....	....	......	Sept. 30	Nov. and next spring	
Apr. 15	12	....	....	......	2 years after planting	May to June 1 after three yrs.	On to July 4
....	....	June 15	3 to 4	Destroy	July 1–15	Sept. 1–15	
....	....	June 15	3 to 4	Destroy	July 1–15	Sept. 1–15	
....	....	....	....	......	Aug. 1–15	Sept. 30 on	
....	....	June 15	3	Greens	June 15–30	Aug. 1	
....	....	July 1–15	4	Greens	Sept. 15–30	Oct. 15	
Apr. 15–30	18	....	....	......	Aug. 1–15	Oct. 15 on	
Apr. 15–30	18	....	....	......	July 1–15	Sept. 1	
June 15–30	24	....	....	......	Aug. 15–30	Nov. 1 on	All winter
May 20–30	24	....	....	......	July 30	Oct. 30 on	All winter
May 20–30	24	....	....	......	July 30	Oct. 30 on	All winter
....	....	June 1–15	2	Destroy	July 1–15	Aug. 15	
....	....	June 1–15	3	Destroy	July 15–30	Oct. 1–15	
June 20–30	18	....	....	......	Aug. 1–15	Oct. 15	To store for winter
June 10–20	10 to 12	....	....	......	Sept. 15	Nov. 1 on	Winter
May 1–10	4	....	....	......	June 1–15	July 15	
June 10–20	5 to 6	....	....	......	Sept. 15	Nov. 1 on	Winter
....	....	June 15	12	Greens	June 15–30	July 15	
....	....	July 1–4, plants	Hills 18	Destroy	July 20–30	Aug. 5	
....	....	July 15	To 4 plants in hill	Destroy	Aug. 1–15	Sept. 1	
....	....	July 30	To 3 plants in hill	Destroy	Sept. 1–15	Sept. 30	
....	....	July 1–15	6	Destroy	Aug. 15-30	Sept. 15-30	
May 20–30	15	....	....	......	Sept. 1	Sept. 15	
....	....	June 15	12	Greens	Sept. 15	Oct. 30	
Apr. 15	12	....	....	......	Nov. 1 on	Fall and next spring	Winter
June 15–30	9	....	....	......	July 30	Aug. 15-30	
May 1–10	3	....	....	......	June 1	July 15	
Apr.–Aug.	7 x 7 in hotbed, 10 outside	....	....	......	May 20-30	All seasons	
....	....	June 15	6	Destroy	Aug. 15-30	Oct. 15	
May 15–30	12	....	....	......	July 15–30	Sept. 30	
Apr. 1–30	3	....	....	......	June 1–15	Aug. 15-30	
....	....	June 1–15	4	Destroy	Sept. 1	Oct. 30 on	Again in spring
....	....	....	....	......	June 15-20	July 1	
....	....	....	....	......	July 1–15	July 30	
....	....	....	....	......	July 30	Aug. 15-30	
May 20–30	12	....	....	......	Aug. 15	Oct. 1–15	
....	....	....	....	......	June 15	Aug. 1	
....	....	....	....	......	Aug. 15-30	Oct. 15	For winter
....	....	June 15	2 in hill	Destroy	Oct. 1	Oct. 15	For winter
....	....	....	....	......	May 1	All seasons	
....	....	June 15	2 to 6	Destroy	Sept. 1	Oct. 15	Winter
Apr. 15	36	....	....	......	May 15	July 15	
....	....	June 1–15	4	Destroy	Sept. 1	Oct. 30 on	Winter
....	....	May 30 on	3	Destroy or greens	May 15-30	June 30 on	
....	....	June 15	3 or 4 in hill 3 ft.	Destroy	June 15	July 15	
....	....	June 15 on	2 or 3 in hill 6 ft.	Destroy	Sept. 1	Oct. 15	Winter
May 20–30	36	....	....	......	June 15-30	Sept. 15-30	
....	....	May 15	6	Destroy	June 1–15	Aug. 1–Sept. 15	

Vegetable	Number of row	Amount of seed	Cost of seed	Planting: Time	Planting: Method	Planting: Depth (inches)	Planting: Distance apart of seed (inches)
Turnips, late	20	2 oz.	$0.20	July 15–20	Drills	½	¼ to ½
Balm			.05				
Basil, sweet			.05				
Caraway			.05				
Catnip			.10				
Dill	Herb bed	1 pkg. each	.05	May 1–15	Hotbed	¼ to ½	¼ to ½
Horehound			.05				
Mint			.25				
Sage			.05				
Savory, summer			.05				
Thyme			.05				
			$0.95				
Brought forward			27.75				
Total			$28.70				

There is no good reason why production from a garden of this size cannot begin early in the spring and last through until the next spring. Ten well-built hotbeds, each hotbed of one sash, as outlined in the plan, may be devoted to the following plants: lettuce in two beds, later in one than in the other; in other beds, radishes, beets, very early spinach, and carrots, respectively, one kind of vegetable to each bed; in another, plants for renewing any of the above-named; the three remaining beds should be given over to the raising of plants for transplanting.

Cold-frames can follow the hotbeds, one or two being used for raising very early sweet corn, one or more for early beans, others for cucumbers, cauliflower, spinach, cabbage, late beets, onions (rare ripes), and so on. Enough frames should be left empty to provide places for transplanting seedlings raised in the hotbeds. After one crop is harvested another may be planned to follow, and so on throughout the season. It is by such planning, successfully carried out, that the greatest profit is obtained from a garden.

The herb patch should contain ten or twelve of the kinds of herbs most desired, the rows preferably running the short way of the bed.

Interplanting in a garden of this kind is practiced only between plants in the rows unless one has the time to devote to more intensive culture, in which case there is plenty of space for succession or companion cropping of the highest type. If time is limited, as it generally is on the farm, interplanting can be done away with entirely.

The number of hotbeds and cold-frames can be reduced. Enough of these should be provided, however, to produce seedlings for transplanting, allowing the crops to be brought to maturity outside in the garden.

BY 200 FEET (*continued*)

Transplanting		Thinning			Harvesting		Remarks
Time	Distance apart of plants (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	
....	....	Aug. 1	10 to 12	Destroy	Sept. 15	Oct. 15	

In many places a farmer may prefer not to practice succession cropping, but would rather cultivate and care for more land. If such is the case, the garden may be enlarged and the succession crops placed in rows for culture. This practice, however, is not to be recommended, as it is better to spend the labor on small acreage rather than on large and to concentrate all the available garden manure on the smaller plot of ground; by so doing, the farmer will receive better returns in size and quality of plants.

The farmer and his family should plan to have for consumption, on the dates named, the following vegetables:

March 15–20

Radishes
Lettuce (leaves)
} from hotbeds

March 20–30

Radishes
Lettuce (leaves)
Spinach
} from hotbeds

April 1–15

Radishes
Lettuce (head)
Spinach
Beet greens
} from hotbeds

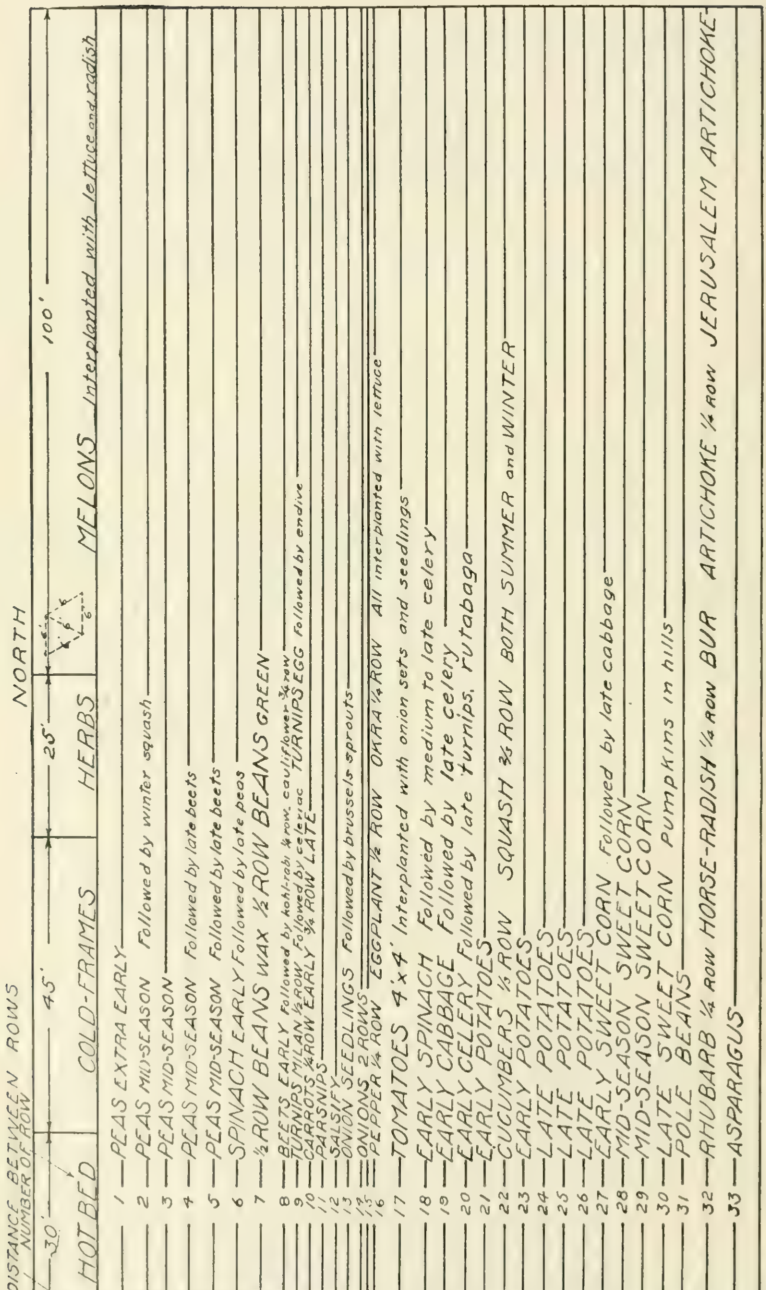

FIG. 53.— *Plan for garden 110 by 200 feet in size*

April 15–30

Radishes Lettuce Spinach Beets (small) Cress Endive Parsley	from hotbeds

Fig. 54.— *Green Curled endive. Tied for blanching*

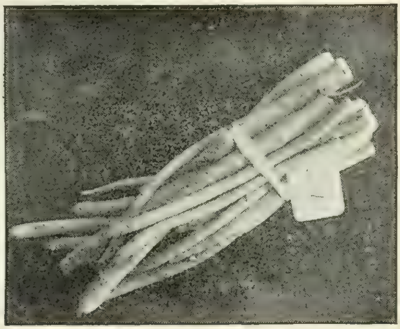

Fig. 55.— *Horse-radish sets*

May 1–15

Radishes Lettuce (head) Spinach Beets Carrots Cress Endive Parsley Rhubarb	from hotbeds and cold-frames, and from the garden

May 15–30

Radishes Lettuce Spinach Beets Carrots Cress	Endive Parsley Rhubarb Asparagus Cauliflower Turnips	from hotbeds and cold-frames, and from the garden

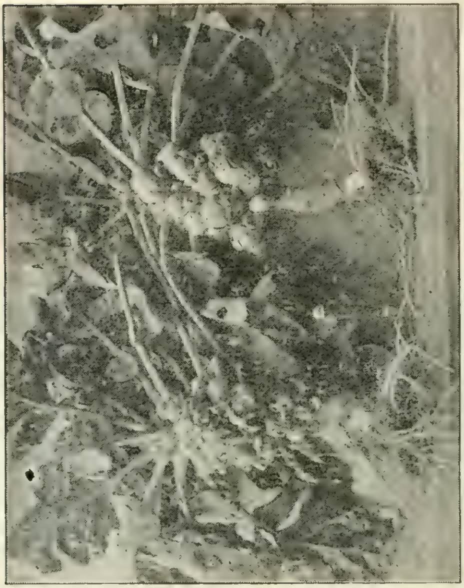

FIG. 58.— *Brussels sprouts*

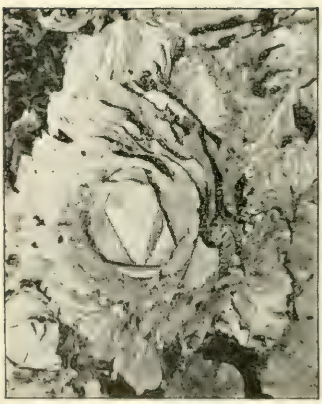

FIG. 56.— *Choice head of cabbage*

FIG. 57.— *An especially fine head of cauliflower*

FIG. 59.— *Rhubarb root at left, ready for late winter forcing. Asparagus root at right, ready for very early spring forcing*

FIG. 60.— *Cauliflower interplanted with lettuce. Two crops on the same ground at the same time, resulting in greater returns per square foot of surface used*

June 1–15

Radishes	Parsley	Beans
Lettuce	Rhubarb	Celery
Spinach	Asparagus	Leek
Beets	Cauliflower	Onions
Carrots	Turnips	Peas
Cabbage		

from hotbeds and cold-frames, and from the garden

June 15–30

The vegetables named above
Swiss chard
Potatoes
Squash (crookneck and white)
Tomatoes
from the garden

FIG. 61.—*Good potatoes*

July 1–15

The vegetables named above
Beans (wax and green)
Cabbage
Carrots (one-half long)
Mid-season peas
from the garden

July 15–30

The new vegetables ready between these dates are:

Carrots (long)
Early sweet corn (outside-grown)
Kohl-rabi
Okra

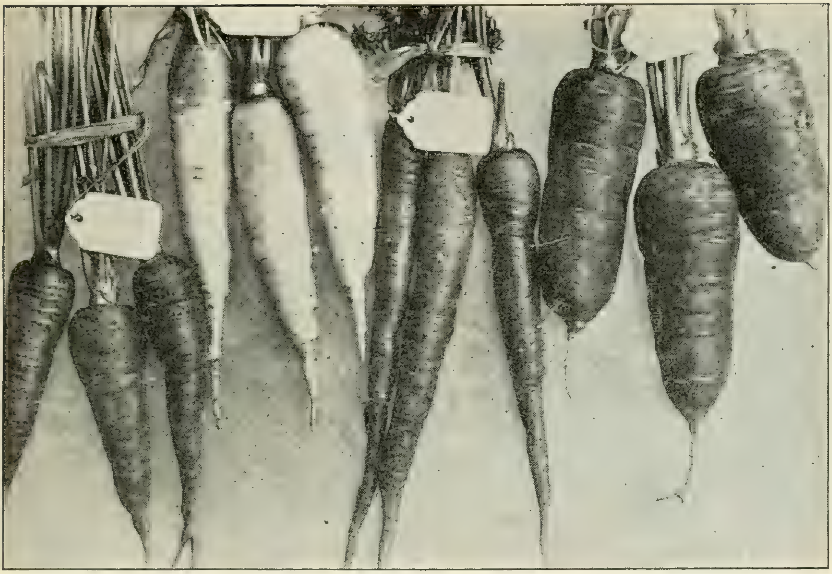

FIG. 62.— *Collection of carrots*

FIG. 63.— *Beets in variety. The bunch at the left is the most desirable kind*

August 1–15

The new vegetables ready between these dates are:

Beans (shell)	Cauliflower (from outside)
Brussels sprouts	Mid-season sweet corn
Red cabbage	Late peas
Savoy cabbage	

August 15–30

The new vegetables ready between these dates are:

Late cabbage	Peppers
Cucumbers (outside-grown)	Late potatoes
Muskmelons	

September 1–15

The new vegetables ready between these dates are:

Bur, or globe, artichokes	Parsnips
	Winter radishes
Late corn	Salsify
Eggplant	Late squash

September 15–30

The new vegetables ready between these dates are:

Jerusalem artichokes	Celeriac
Late beets	Turnips
Late celery	

October 1–15

Pumpkins

October 15–30

Herbs harvested

The following should be supplied for storage and winter consumption:

Jerusalem artichokes	Parsnips
Beets	Winter radishes
Carrots	Horse-radish
Celery	Salsify
Cabbage	Squash
Celeriac	Turnips
Potatoes	Onions
Pumpkins	

Besides all the vegetables named above, the fall and early winter supply can be increased by planning to run the cold-frames and hotbeds with such crops as radishes, lettuce, spinach, endive, parsley, and so on, so far as time and labor will permit.

FIG. 64.— *Ruby King pepper. A very desirable sort*

If a smaller number of varieties is desired, these may be chosen to suit the preference or the convenience of the farmer. The garden may consist merely of corn, potatoes, and beans; or, with better management as to planning, preparation of the soil, more systematic planting, reasonable after-care, and proper harvesting, the kinds of vegetables may be increased in number.

The implements and materials needed for this garden are: Those mentioned in plans 1 and 2, together with the use of a horse and an eleven-point cultivator; twenty-five, or fewer, sashes for hotbeds and cold-frames, costing $1.75 each; boards, nails, and other material with which to construct hotbeds and cold-frames; manure for the hotbeds, preferably that produced on the farm; soil for both pits and frames; stakes for marking rows, staking plants, and other purposes.

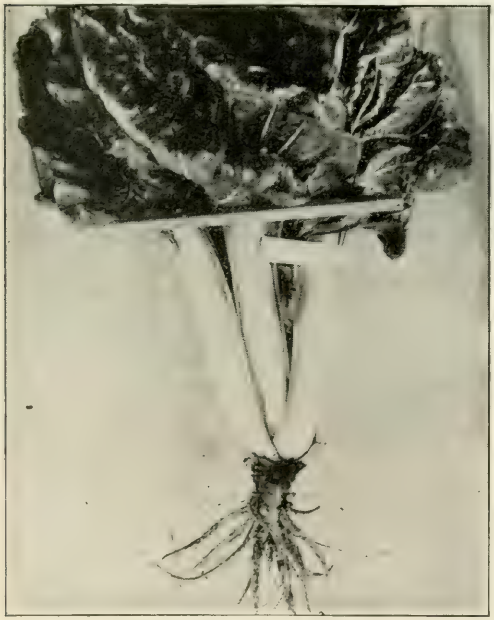

FIG. 65.— *Swiss chard*

The amount of manure required for a garden of this size is so great that it is very hard to advise just how to supply it. Generally speaking, the farmer should apply a very liberal quantity of the best well-rotted stable manure, six to eight cords being none too much.

If manure is insufficient in quantity a high-grade commercial fertilizer must be supplied. One hundred pounds of fertilizer should be provided for every cord of manure lacking to make up six cords.

FIG. 66.— *Onions*

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 34 | ITHACA, N. Y. FEBRUARY 15, 1913 | VEGETABLE-GARDENING SERIES No. 2

HOME-GARDEN PLANNING

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. The answering of the questions is optional, but a majority of readers accept this opportunity for additional work. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read.

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Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

1. Do you follow a definite method in planning your garden? If so, describe it.

2. What vegetables do you plan to raise? State the variety, where the seed is obtained, the quantity of seed provided, its cost, and the number of feet or hills to be planted.

3. What is the size of your garden? How near is it to the house? Of what kind of soil does it consist? Does it have a southern exposure? If not, in what direction does it face?

4. Do you plan for a constant supply of vegetables for consumption during the summer? Do you provide enough vegetables for winter storage, also? If so, give a list of the vegetables and the dates when they are used.

5. Are you planning to produce the largest amount of vegetables per square foot of garden? If so, describe your plans.

6. What amount in dollars and cents do you consider your garden worth to you? Can you support your answer by facts or reasons?

7. Is there any way by which you could increase the value of your garden?

8. Is there any way in which you desire the State College of Agriculture to assist you?

Name..

Address..

Date..

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 36 | ITHACA, N. Y. MARCH 15, 1913 | FRUIT-GROWING SERIES No. 3

CULTURE OF RED AND BLACK RASPBERRIES AND OF PURPLE-CANE VARIETIES

C. S. WILSON

THE RED RASPBERRY

The red raspberry is the most popular of the bush-fruits. It is sought by the consumer because of its beautiful appearance and its high quality

FIG. 67.—*Picking time*

and flavor, and it is welcomed by the retailer because it brings a good price. The red raspberry is grown on a large number of farms as a commercial product, and in many home gardens. It deserves to be more widely grown commercially and it should be in every home garden. In

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season it follows closely the strawberry, and, like the latter, is relished when eaten fresh or in the form of desserts, jams, jellies, and the like.

Nearly all varieties are hardy in the United States. Many varieties are hardy when grown as far north as Canada, where this fruit has a wider range than has the blackcap. It is true, however, that the red raspberry often suffers from winter injury. Probably such injury is the result of disease, drought, or excessive moisture, rather than the inability of the plant under favorable conditions to withstand the cold winters. In most sections of New York the grower should not hesitate to plant the red raspberry because of fear of winter injury.

Eight to ten crops of berries may be expected from a patch, provided the plants are given good care and are kept free from disease. In a study of this fruit during the summer of 1910, an effort was made to find out whether there was any difference in the yield of a patch at different ages, and, if so, at what age the patch was most productive. The following table, although not conclusive since it does not include a large area, is nevertheless interesting and suggestive and indicates the possibilities of the older patch:

Age of plants	Number of farms	Number of acres	Average yield per acre (quarts)	Average income per acre
Two years (first picking)	8	7.5	828	$ 75.71
Three to five years	39	79.3	1,348	143.46
Ten years	4	12.0	1,427	148.01

Soils

The red raspberry will do well on both light and heavy soils, excepting the extremes in either case. It is probable that the texture of the soil is, within reasonable limits, of less importance than certain other soil properties that the plant requires. It is known, for example, that the soil for the red raspberry should be well drained, either naturally or artificially, and that it should be moist and cool. The grower should avoid a soil on which plants are liable to drought or to excessive moisture, because the red raspberry is one of the first fruits to suffer from these conditions.

A survey in western New York showed that most of the red raspberry patches are on gravelly and sandy soils. The table below substantiates this statement and also indicates the possibilities of production on the heavier types of soil:

1910	Number of acres	Number of farms	Yield per acre (quarts)	Income per acre
Gravelly loam	63.5	40	1,414	$141.43
Sandy loam	30.6	21	1,306	147.29
Clay loam	7.4	7	2,097	237.40

Exposure

The largest and sweetest fruit, in the case of the red raspberry, grows in the shade. Probably most persons will recall that this is true of the wild berries in the woods, or when a cluster grows in the center of the bush in the garden. In view of this, and since the red raspberry does not thrive best in the scorching sun, a northern or western exposure is preferable for commercial patches. In the garden a cool, shady spot should be chosen, but the grower should not hesitate to plant elsewhere if these conditions cannot be met.

Propagation

The common method of increasing the red raspberry is to dig up and transplant the suckers that spring from the roots. These are really root cuttings, as explained below. During the summer a large number of sprouts, or suckers as they are called, spring up from the roots. These suckers come up naturally, even though the roots are undisturbed, but their growth can be directed in number and position by wounding the roots of the parent plant. A sucker can be expected wherever the root is wounded. The cultivator often breaks the roots and probably is responsible for many suckers that come up between the rows.

The young plants should be so dug up as to remove a part of the horizontal root with them if possible. They are then really root cuttings, although this term is commonly applied to pieces of the root of the parent plant from which no growth has started, as explained in the following paragraph. These cuttings may be transplanted in either spring or autumn, preferably at the latter season.

Most varieties sprout freely and no other method of propagation is needed. A few varieties, however, send up suckers sparingly, and in that case it is necessary to resort to root cuttings. In this method the roots of the plant are dug up in autumn and cut into pieces three or four inches in length. The pieces are stored in a cool cellar during the winter, usually being buried in moist sand in flats. In spring they are planted in ground that has been well prepared. The cutting may be placed

horizontally in the bottom of a furrow and covered with dirt, or it may be set up obliquely against the side of the furrow and deep enough so that after covering only the top projects. Budd and Hansen* prefer the latter method and state that long experience has shown this method to give the more even stand. If planted obliquely, care should be exercised to set the cuttings right end up, although they would probably grow if placed wrong end up.

The method of propagation by suckers, as described above, and the

FIG. 68.—*A patch of red raspberries at the New York (Geneva) Agricultural Experiment Station*

method known as root cuttings, are in reality the same. In the former case the root is left undisturbed and the sucker arising from it is transplanted. In the latter case the root is dug up, cut into pieces, and the pieces planted. From each piece it is expected that a sucker will grow. In one case the suckers are taken as they happen to grow, whereas in the other case their growth is directed in number and position.

Varieties

The question of varieties is an exceedingly important one, both for commercial planting and for the home garden. The commercial grower must

* Budd and Hansen. American Horticultural Manual, Vol. I, p. 44.

choose varieties for large yields, attractive appearance, holding-up properties when shipped, and resistance to diseases and insect pests. While it is desirable that varieties for home use possess these properties also, the characters of flavor and quality are of greater importance for them.

There are only two varieties grown commercially in western New York, Marlboro and Cuthbert. Marlboro is an early variety, ripening about a week before Cuthbert. Its earliness, together with other good qualities, makes it the best commercial variety for its season. All things considered, Cuthbert is the best variety and is grown more than any other. Being widely adapted to different conditions, it is to the red raspberry what the Baldwin is to the apple or the Concord is to the grape. The extent of commercial plantings of these two varieties is shown in the following table:

1910	Number of acres	Yield per acre (quarts)	Income per acre
Marlboro	39	1,397	$145.31
Cuthbert	90	1,322	139.17

It will be noticed that the yields are about the same for each variety. Marlboro brings a better price, but this is probably because it ripens about a week earlier.

A variety known as Early King is grown to a limited extent in western New York. Although it has not been tested sufficiently to prove its worth, there is some doubt as to whether it will succeed. The fruit has a tendency to fall from the canes when disturbed, and the berries are likely to crumble and do not keep well. Growers assert that this variety does best on clay.

June is an extra early variety that was originated a few years ago at the New York (Geneva) Agricultural Experiment Station. This variety, while possessing the desirable qualities of the others, is in addition so much earlier than they are that the writer suggests it for the home garden.

Herbert is another variety of promise, which originated with R. B. Whyte, Ottawa, Canada, in 1887, but which only recently came to the writer's notice as a variety of commercial importance. It ripens about the same time as Cuthbert, and in Canada ranks next as a main crop variety.

Occasionally one wishes to grow the yellow raspberry for home use. The variety that is generally recommended and that has proved reliable is Golden Queen.

The principal varieties of red raspberries may be briefly described as follows:

Marlboro.— Usually productive; fruit medium to large, crimson, flesh firm and juicy, quality medium; bush upright, not so rank a grower as Cuthbert, hardy. The standard early variety, ripening about one week earlier than Cuthbert.

Cuthbert.— Standard main crop variety; productive; fruit large, dull red, good quality; an excellent shipper; bush strong grower, moderately hardy.

Herbert.— Very productive; fruit large, bright red, juicy, quality very good; season medium; bush very hardy. In Canada Herbert will probably replace Cuthbert for home use.

Planting

The red raspberry is planted in either autumn or spring. If suckers are transplanted from the grower's own patch, as is often the case in commercial work, the best time is early September. This gives the plants sufficient time to establish themselves in the soil before winter, and there is very little danger of winterkilling. If the work cannot be done in early autumn, it would probably be better to wait until spring rather than do the planting late in the fall. Spring planting should be done as early as convenient, so that the plants will not be seriously retarded in starting. Some growers in western New York are setting new patches in May, using young sprouts that have grown the same spring. Wherever the plan has been tried the growers agree that it has been successful.

Generally the rows are six feet apart with the plants three feet apart in the row. Marlboro may be planted at this distance. In the case of other varieties, when it is difficult to keep canes and suckers from getting too thick, the distance between the rows should be increased. Cuthbert, for example, should be planted not closer than seven or eight feet. Growers who plant as far as eight feet apart are satisfied with that distance, asserting that the ease of cultivation makes up for the slight loss in yield, if there is any loss at all.

In this connection it is suggested that the plants be set in rows running crosswise as well as lengthwise, so that the grower can cultivate both ways. Five feet by five feet is convenient. Or the filler system might be tried, the rows being set five feet apart and the plants two and one half feet apart in the row; in this case, after a few crops are picked and when the rows begin to get too thick, the grower can cut out every other plant in the row, leaving the plants five feet apart each way as suggested in the former method. It is believed that the latter method will give no decrease

in yield, and that it has the advantage of producing uniformly larger berries at a less cost.

The ground is well prepared previous to planting. The rows are marked off both lengthwise and crosswise and a deep furrow is run one way with the plow, thus preparing the ground as regards the place in which to set the plants and the digging of the holes. In order to secure protection from drought, the plants should be set three or four inches deeper than

FIG. 69.—*Shaffer and Cuthbert*

they stood in the row. Part of the dirt is thrown back at once and pressed firmly around the roots. Later, as the new sprouts grow, the hole is gradually filled by working dirt around the plants with a cultivator or a hoe.

Tillage

The patch should be thoroughly tilled and, if necessary, carefully hoed each year. The character of the tillage should be such as to conserve moisture, destroy weeds, and thin out suckers. There are two principles involved in the method which deserve a full discussion, namely, plowing and cultivating.

Plowing.— Plowing in spring or autumn is practiced to some extent in western New York in the case of the red raspberry, the main reason being to limit the width of the row. If the suckers that spring up from the roots are not checked, the row will become so wide and the canes so thick that the quality and quantity of the berries are decreased. A good practice is to limit the width of the row to eight or twelve inches. Another reason for plowing is to prevent heaving. The best practice is to throw a light furrow up to the canes in autumn, and then plow it away in spring or else work it away with a shovel cultivator. The plow is of little value in the red raspberry patch as an aid in tillage, except for the purposes mentioned above and when a cover-crop must be turned under. Growers get good results with the use of the cultivator alone.

Cultivating.— The work of cultivating is begun as early in spring as possible and repeated about every two weeks until picking begins, except during blossoming time or when the fruit is setting. Generally the patch is given one good cultivation after picking in order to keep down weeds. Some growers cultivate after each picking if the season is dry, although it is not the common practice. A moderate growth of weeds is allowed in August or September as a catch or robber crop. Although it is the exception to plant a cover-crop, a few growers are doing this with good results, the crops used being oats and clover. This practice is worthy of further trial.

Fertilization

The red raspberry should receive a moderate amount of fertilizer, either stable manure or commercial fertilizer or both, during the life of the patch. It is true that this fruit will give good returns with less fertilizer than is required by the currant and the gooseberry. It is not true, however, as is sometimes stated, that the raspberry requires no fertilization. Professor Craig* states that raspberries are not often, nor are they easily, injured by too heavy manuring, the error usually being on the other side. Card† believes that red raspberries need fertilizing when grown on very unproductive land. If this is the case, he would apply both stable manure and commercial fertilizer, but in less quantities than for most other fruits. He gives the following formula for a commercial fertilizer to be applied to one acre, in connection with stable manure, and harrowed in before setting the plants:

Muriate of potash	50 pounds
Ground bone	250 pounds

In the study of the red raspberry in western New York, an effort was made to find out what was the general practice as regards the

* John Craig. Raspberries. Bulletin 22, Central Experimental Farm, Ottawa, Canada, p. 6.
† F. W. Card. Bush-Fruits, p. 45.

application of fertilizer and how the results compared for the different methods. The common practice with most growers is to apply fertilizer, in the form of stable manure or commercial mixtures, before the plants are set out. This is done in the case of practically all the patches. After the plants come into bearing the practice differs, some growers applying fertilizers in one form or another while many apply nothing at all. If fertilizer is applied it may be stable manure or commercial fertilizer or both. The following table shows the practice in this respect, and gives the yield and income per acre under the different methods:

Method	Number of farms	Number of acres	Yield per acre (quarts)	Income per acre
No manure nor commercial fertilizer	39	81	1,168.0	$116.69
Manure and commercial fertilizer	13	14	1,526.7	176.69
Commercial fertilizer only	10	30	1,439.0	142.85
Manure only	21	23	1,472.0	170.50

The table indicates clearly that fertilizers are beneficial. The best results are obtained when stable manure is applied, either alone or in connection with commercial fertilizer. Commercial fertilizer alone is beneficial, but does not seem to give so good results as does stable manure alone. It should be explained that the expression "Manure and commercial fertilizer," under "Method," means that stable manure is applied one year and commercial fertilizer the next. They are seldom applied together.

Pruning

The pruning of the red raspberry will be better understood if the pruner knows the habit of growth of the plant. A new cane springs up and develops during the summer; the next spring this cane throws out fruit clusters, bears fruit, and dies that year. The root is perennial and the cane is biennial. The object of the pruner, then, should be: first, to remove the old wood as soon as it dies in order to give the new wood room in which to grow; second, to secure, both by thinning and by heading-in, canes of sufficient vigor and development to produce the most and the largest fruit.

The following definite directions are given as an aid to the reader:

At planting.— The top should be cut back to four or six inches from the ground. If sprouts are transplanted in May or in early autumn, they need not be cut back until the following spring.

Bearing patch.— The general practice in the case of the red raspberry is, first, to take out the old wood as soon as possible after picking, and,

second, to head back the new shoots to three or four feet in the spring. In addition, many growers formerly practiced what is known as summer pruning, or the pinching back of the new canes when they have reached a height of two or three feet. This was done in order to make them branch, as it was believed that a branched cane carried more fruit buds than a straight cane. At the present time, however, this practice is not looked upon with favor. It is necessary in the case of the black raspberry and the blackberry, but with the red raspberry the operation seems to force up too many suckers from the roots. The side branches that develop are also often weak and immature.

Summer pruning is now the exception rather than the rule, although the few men who practice it are successful growers. They do the work mostly in early July and, as a result, secure a low-branching bush. The red raspberry patch seldom becomes unmanageable because of too vigorous cane growth, and this is probably the reason why summer pruning is not found necessary.

It is occasionally recommended to leave the old canes until spring. There seems to be no special advantage in doing this. The snow is not heavy enough to break the new canes, nor are the winters severe enough in New York to require this additional protection.

The common practice in spring pruning is to cut off the tips as early as possible, leaving the canes three or four feet high. In the case of the Marlboro this pruning would be less severe, inasmuch as the plants of this variety are naturally lower and more branching than those of the Cuthbert. A few growers perform this operation in autumn after the canes have matured, but it is not the best time. They do not remove the frozen tips, which of course is done if spring pruning is practiced.

Picking and marketing

The patch should be picked over often. The fruit is soft and deteriorates quickly when overripe. The grower should never pick the fruit when wet, and should be careful to take it from the bush without bruising. It should be placed in the shade immediately and kept cool.

In western New York the red raspberry is picked mainly in quart baskets and placed in crates or carriers. Most of the fruit is sold to local commission men or to local buyers, although a few growers take the fruit directly to the market. The local dealers ship the fruit mainly to Pittsburg, Johnstown, and Rochester.

Drying

The red raspberry is sometimes dried, but not so often as is the black raspberry. The shrinkage in the case of the red raspberry is too great to warrant drying on a large scale A quart of fresh berries will make

about four ounces of dried fruit, which means that the grower will get about seven or eight pounds of dried fruit per bushel. Moreover, the red raspberry, when dried, takes on a dull red color that is not attractive.

Yields and incomes

The yield of the red raspberry is generally not so large as that of the other bush-fruits. Card* reports an average, derived from the replies of fifty-six growers, of about sixty-nine bushels, or 2,208 quarts, per acre. At the Central Experimental Farm, Canada,† the Herbert produced at the rate of 205 bushels, or 6,560 quarts, and the Brighton at the rate of 175 bushels, or 5,600 quarts, per acre. In this case the rate per acre was computed from the yield of a small area, and, although such large returns will not be obtained from a commercial patch, they indicate the possibility of increased yields with good care.

The average yields and incomes for western New York for the years 1910 and 1909 are shown in the following table:

	Number of acres	Yield per acre (quarts)	Income per acre	Average price per year per quart
1910	155	1,351.09	$139.75	$.1034
1909	52	1,784.15	162.91	.0913

The average price per quart, as shown by this table, is about ten cents. This is higher than the price received per quart for the other bush-fruits. Considering, however, the smaller yield of the red raspberry and the fact that the picking season is distributed over a longer period of time, this higher price would be expected.

Insect pests and diseases

The insect pests and diseases to which this fruit is subject are much the same as those that attack the black raspberry and the purple-cane varieties. A brief description of the most important of these pests and diseases, together with the methods of control, is contained in the closing pages of this lesson.

THE BLACK RASPBERRY

In most sections of New York the black raspberry is grown to a less extent than is the red. It is of considerable importance, however, and seems everywhere to be gaining in favor. The objections to it have been that the fruit is seedier and smaller than the fruit of the red varieties,

* F. W. Card. Bush-Fruits, p. 58.
† Bush-Fruits. Bulletin 56, Central Experimental Farm, Ottawa, Canada.

consequently it has been in less demand. These points of objection, however, are rapidly disappearing through the improvement of the older, and the introduction of newer, varieties.

On the other hand, the black raspberry has its advantages. It yields more heavily than does the red, the fruit has a very pleasant flavor, and it can be bought at a lower price per quart. All these points combine to bring it within the reach of more persons, making it desirable and popular for dessert purposes, for which it is chiefly used in New York.

In hardiness the black raspberry is nearly equal to the red. It may be

FIG. 70.—*A patch of Greggs*

planted in most sections of New York State without danger of serious injury from winterkilling. It produces a smaller number of crops from a single patch than does the red raspberry. Usually the grower can count on about four good crops. After that it is difficult to keep down weeds and to secure a sufficiently vigorous growth of canes to produce large berries. Since it is easy to set out a new patch, it is more desirable to do this than to continue the cropping of the old one after the fourth crop is taken off. The patch would then be renewed every six or seven years.

Soils

In the main, the suggestions regarding the soil for the red raspberry are equally applicable to the black. The only difference that should be noted is that the black raspberry seems to prefer the lighter, warmer soils

to a more marked degree. The studies in western New York bear out this statement, as is shown by the following table:

Soils	Acreage	Yield per acre (quarts)	Income per acre
Sandy loam	77.85	1,434.50	$106.59
Gravelly loam	51.08	1,405.40	107.05
Clay soils	10.25	1,266.05	100.83

Propagation

The black raspberry is propagated by means of tip layers. Briefly, the method is as follows: When the canes have made sufficient growth and,

FIG. 71.—*A cluster of Gregg*

in accordance with the natural habit of the plant, have bent over nearly to the ground, the tips of the canes are covered with soil. In New York

this takes place about the middle of August, or a little later. The cautions to be observed in covering the tip of the cane are (1) to avoid burying it too deep and (2) to secure it firmly. The tip will take root readily if it only touches the soil, but in commercial work, in which case the ground is cultivated, it is necessary to secure the tip in some way so that it will not be blown about by the wind. A light covering of soil that does not interfere with its growth is the easiest way of fastening the tip to the ground. It is sometimes recommended to pin the tip down by means of a wooden stake or a small stone. This method may do for the amateur, but is not necessary, as a rule, in commercial practice. The tip will have rooted well by autumn and may be transplanted the following spring. Usually the old cane is cut off about six inches above the ground and used as a handle in moving the young plant. When the transplanting is done in spring there is danger of smothering the young bud if the tips are covered with more than two inches of soil.

The method of propagation differs in the black and the red raspberry because the growth of the plants is unlike. In the red raspberry the single canes spring from horizontal roots, which spread out two or three inches beneath the surface of the soil; whereas in the black raspberry the canes rise from a well-defined crown, not from the horizontal roots. Again, the growth of the canes of the red raspberry is upright, whereas the canes of the black raspberry naturally grow longer and droop to the ground. Man has merely followed nature's method of propagation in each case.

Varieties

The survey in western New York shows that there are four main crop varieties — Kansas, Palmer, Black Diamond, and Cumberland. Kansas is the favorite because it is an excellent variety and is easy to propagate. It produces a large berry and is a heavy and reliable cropper. Palmer is the earliest, and is popular both for this reason and because of the fact that it is a good variety in other respects. It succeeds best on the earlier soils. An objection to this variety is that the fruit grows under the leaves, which makes it harder to pick. Black Diamond is a variety that is increasing in favor, especially with growers around North Collins in Monroe county. The bush is a large, vigorous grower and is productive. It is less susceptible to anthracnose than are the other varieties. Cumberland is a strong, vigorous grower and the berries are large, but it does not seem to hold up so well when shipped as do some other varieties. The relative importance of these varieties in western New York, as shown by the number of farms on which they are grown and the total number of acres of each, is as follows:

Variety	Number of farms	Number of acres
Kansas	22	52.36
Black Diamond	6	20.50
Palmer	7	18.00
Kansas and Black Diamond	5	38.50
Kansas and Cumberland	5	6.08

Other varieties of black raspberries that are grown commercially in western New York are Eureka, Gregg, Ohio, Ebony, and Tyler. In Monroe county, as the surveys indicate, Black Diamond is the most popular. Other varieties planted there are the Ohio and Gregg. One of the newer varieties that promises well is Plum Farmer.

The varieties mentioned above are sold on the market as fresh fruit, and are not used to any extent for evaporating. For the latter purpose Ohio has long been, and is still, the leading variety. There are few evaporators for drying berries in western New York, but in some districts, notably in Yates, Wayne, and Ontario counties, a part of the crop is evaporated.

Looking at the variety problem from the standpoint of market preference, the following figures are interesting. The table is based on the replies of twenty-six commission men who were asked the varieties that were most popular with the consumer:

Variety	Number of commission men
Gregg	8
Cumberland	6
Kansas	4
Tyler	3
Palmer	2
Ohio	2
Black Diamond	1

A brief description of varieties follows:

Kansas.— Very productive; fruit large, glossy, black, sweet, firm; season about a week earlier than Gregg; bush moderately vigorous. New variety, which has made rapid advances.

Black Diamond.— Very productive; berry large, firm, and a good shipper if picked in time; season four or five days later than Kansas; bush very vigorous, less susceptible to anthracnose than most varieties.

Palmer.— Productive; fruit medium size, juicy, sweet, firm, good quality; season early; one of the best early varieties for commercial purposes; bush strong grower, lacking somewhat in hardiness.

Cumberland.— Productive; fruit large, black, sweet, firm, quality good; season medium early; bush strong, vigorous, hardy.

Ohio.— Productive; fruit medium, black, firm, very seedy; season medium; bush strong grower, lacking somewhat in hardiness. Best variety for evaporating. This variety yields more dried fruit to the bushel than does any other variety.

Gregg.— Productive; fruit large, black, moderately juicy, sweet, good quality; season late; bush strong grower, somewhat lacking in hardiness. One of the old standard varieties.

Management

The directions for planting, tilling, and fertilizing as given for the red raspberry apply equally well to the black raspberry. The diseases and insect pests that attack the latter are much the same as those that attack the red raspberry. The description of these and the methods of their control are given in the closing pages of this lesson.

Pruning

There is a slight difference between the methods of pruning the red and the black raspberry, a variation due to different habits of growth. As stated previously, the canes of the black raspberry grow long and droop to the ground, whereas the canes of the red raspberry are shorter and upright. Because of this long-growing and drooping habit of growth of the canes, growers pinch off the tips of the black raspberry in order to make the canes branch. A branched cane is desired because it contains more fruit buds than does a straight cane.

The work is done when the canes are twenty-four to thirty inches high, which in New York is usually during late June or July. If it is done in time the tender tips may be pinched off with the fingers and the use of shears is not necessary. The patch must be gone over more than once, since the canes will not all reach the desired height at the same time. The last pruning can be done during picking time as the grower goes back and forth through the patch. The canes then develop lateral branches, which become strong and mature by autumn. These, in turn, are headed back in spring.

The heading-in of these lateral branches in spring is omitted by half the growers. The practice is a good one, provided it is done intelligently, and the point to be considered in such heading-in is the fruiting habit of the variety. In some varieties the fruit clusters develop near the base of the branch, whereas in others they develop near the tip. In the former case the heading-back of the branches is desirable, while in the latter it is not recommended because too much of the fruit-bearing surface is often removed. Probably the reason why this pruning of the laterals is not more widely practiced is because the grower does not know the fruiting habits of the particular varieties in question.

Briefly summarized, the pruning of the black raspberry is as follows: The old canes should be cut out and burned soon after fruiting. The new canes should be pinched back when twenty-four to thirty inches high, and thinned to not more than five or six canes to each crown. This pruning, which is called summer pruning, will be done during June or July. In the spring the lateral branches are cut back so that the remaining buds will develop into strong fruit clusters. The amount of this cutting back will depend on the variety, the bearing habits of which can soon be determined by observation.

Yields and incomes

The yield of the black raspberry is usually a little higher than that of the red. Basing his figures on the replies of fifty-eight growers, Card* computed the average yield to be about 2,493 quarts, or nearly 78 bushels, per acre. In the study in the commercial patches in western New York the yield was somewhat less. The average yield is given below:

Variety	Number of acres	Yield per acre (quarts)	Income per acre
Kansas	52	1,741	$131.04
Black Diamond	20	1,429	103.06
Palmer	18	1,476	111.55
Kansas and Black Diamond	38	1,156	92.59
Kansas and Cumberland	6	1,281	98.71

It is probable that the difference in yields and incomes for the varieties as shown here is due to soil and climatic influences as well as to variety.

Evaporation.— The black raspberry is used for evaporating purposes more than any other bush-fruit. Card, in his book on bush-fruits,† has

* F. W. Card. Bush-Fruits, p. 101.
† F. W. Card. Bush-Fruits, pp. 102–103.

well summarized the yield and income of the black raspberry when evaporated, and the following quotation is from this source:

"The yield in pounds of dried product per bushel of green fruit varies greatly with different seasons and parts of the same season. Early in a wet season, when the fruit has made a quick, vigorous, and watery growth, it may take four quarts to make a pound of dried fruit. At the end of a very dry season, on the other hand, it may take only two quarts. So far as I have been able to learn, growers expect to average about ten pounds of dried fruit to the bushel. There is considerable difference in varieties in this respect. The Ohio is one of the heaviest yielders, in proportion to the amount of green fruit, owing largely to the greater number of seeds. It is one of the poorest in quality, and possesses less food value per bushel than other varieties. The Gregg follows it closely in yield and is a better berry. In some experiments with seedlings, Goff found that small and juicy berries yielded a higher percentage of evaporated fruit than larger and dryer ones, showing that it does not follow because a berry is rather dry in texture that it will give a good yield when evaporated. In point of quality and food value, the Shaffer ranks among the best, so that from the consumer's standpoint, at least, it is one of the most desirable. It is so near a red raspberry that when evaporated its quality is fully equal, if not superior, to that of the true reds, while the yield of dried fruit per bushel is not very far below that of the blackcaps. It is certainly an excellent berry to dry for the home market, where the price can be made to conform to the cost of production.

"The man who is growing berries to evaporate is not likely to suffer so seriously from drought as the one who sells his fruit fresh. Dry weather reduces the number of quarts per acre much more than the number of pounds of dried fruit. A long drought, extending through the early part of the season, does injure the yield, but dry weather at ripening time only, need cause no serious loss if cultivation has been frequent and thorough. In fact, the man who will cultivate thoroughly enough is practically independent of drought.

"Basing an estimate on the above figures for average yields, we may look for 750 pounds of dried fruit per acre, with thoroughly good management. Judging from past experience, this product, through a series of years, is likely to average from fifteen to twenty cents per pound, making a gross return of $112.50 to $150 per acre from fields in full bearing. The cost of harvesting and marketing may be summed up about as follows: Harvesting at one half cent per quart, $12.50; evaporating at two and one half cents per pound, $18.75; cleaning for market at one cent per pound, $7.50; marketing at one cent per pound, $7.50. This leaves about $75 to $100 for rent of land, cost of growing, and profits. On the

whole, raspberry-growing for the purpose of making dried fruit can be recommended with confidence to the general farmer who is willing to give it careful attention."

PURPLE-CANE VARIETIES

The varieties Shaffer and Columbian represent a type of raspberry that is usually considered as a distinct species. This type is intermediate in form between the red and the black raspberry, and because of this inter-

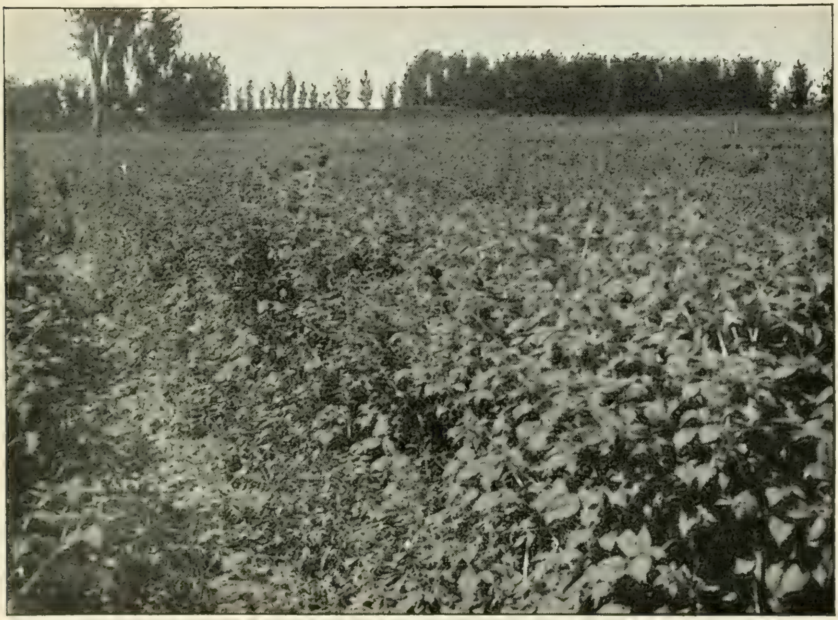

FIG. 72.—*A bearing patch of the Ohio*

mediate character and the fact that crosses between the red and the black produce forms similar to this type some persons consider it of hybrid origin.

The fruit of the purple-cane varieties is of a large size and of a dull, dark red color. The growth of the plant is similar to the growth of the black raspberry, but more vigorous. Professor Craig summarized the characteristics of the purple-cane varieties very well in the following statement:* "Their good points are vigor and productiveness; their weak points are the softness and acidity as well as the unattractive color of the fruit."

The important varieties of the purple-cane raspberry are Shaffer and Columbian, descriptions of which follow:

* Bulletin 22, Central Experimental Farm, Ottawa, Canada.

Shaffer.— Productive; fruit large, dark red or dull purple, flesh moderately firm, somewhat acid, quality medium; season medium to late; bush very vigorous, moderately hardy.

Columbian.— Very productive; fruit large, dark purplish red, firm, quality good; season late; closely resembles Shaffer.

The culture of the purple-cane raspberry is essentially the same as the culture of the black raspberry, which it resembles closely in habits of growth. The bush, however, is larger and more vigorous, and for this reason it is suggested that the plants be set farther apart than is recommended for the black raspberry. In the study of the purple-cane varieties in western New York the following table was prepared, based on different distances of planting. The figures are interesting, as they show the practice of growers in that section in regard to distances of planting and the yields secured.

Method	Number of farms	Number of acres	Yield per acre (quarts)
6 ft. x 5 ft.	8	24	1,667
7 ft. x 3 ft.	11	65	1,739
8 ft. x 3 ft.	4	10	1,709
7 ft. x 4 ft.	4	12	2,324

The yield of the purple-cane varieties is fairly represented above. It is a little larger than the yield of either the black or the red varieties. For the last two years an average price per quart of six or seven cents has been received by growers for this fruit.

DISEASES OF RASPBERRIES

There are four diseases that are more or less troublesome to the grower of raspberries — anthracnose, cane-blight, crown-gall, and red-rust. The brief descriptions of these diseases and the methods of their control which are given below are taken directly from Cornell University Agricultural Experiment Station Bulletin 283* and from Bulletin 56 of the Canadian Experimental Farm.†

Anthracnose

This disease first makes its appearance when the young shoots are twelve to fifteen inches in length, and is recognized by the brownish or purplish patches or depressions on the young shoots and leaf-stalks. As

* The Control of Insect Pests and Plant Diseases, p. 490.
† Bush-Fruits, by W. T. Macoun, p. 57.

the shoots grow the blotches become larger and grayish in the center, and by the end of the season may encircle the cane and practically girdle it. This disease is very destructive to black raspberries, but not often injurious to the red varieties.

Control.— Eradication is the best method of control. All the old canes, and the new ones that are badly diseased, should be cut out and burned as soon as the fruit is gathered. Applications of bordeaux, 5–5–50, will control the malady but this treatment may not be profitable. If spraying seems advisable the first application should be made when the new

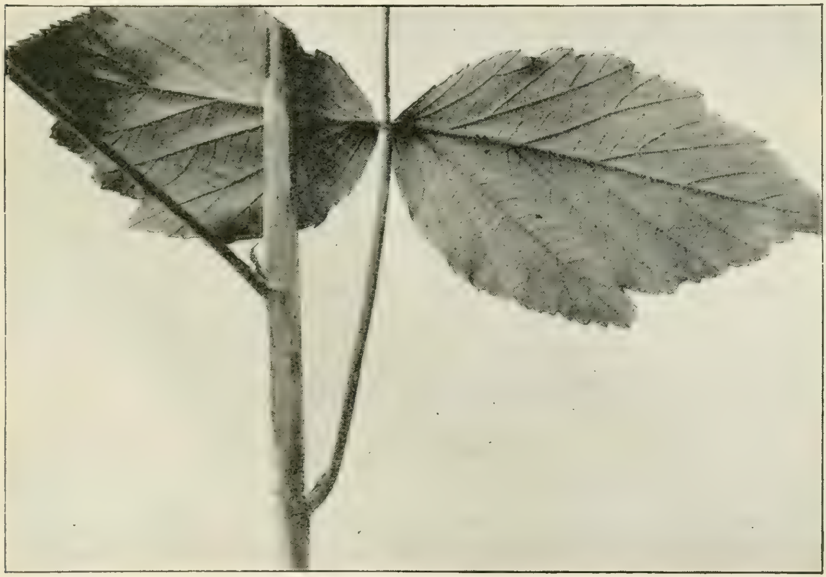

FIG. 73.—*Cane affected with anthracnose. Note pitted or sunken areas*

canes are six to eight inches high. The second and third applications should be made at intervals of ten to fourteen days.*

The grower should be careful to plant new patches where the disease is not prevalent. The departments of Pomology and Plant Pathology of the New York State College of Agriculture at Cornell University are now studying cooperatively different spraying mixtures for controlling this disease.

Cane-blight, or -wilt

This disease affects both red and black varieties. It is caused by a fungus that attacks the cane at some point and kills the bark and wood. That part of the fruit cane above the diseased portion suddenly

*New York (Geneva) Agricultural Experiment Station Bulletin 124.

wilts and dies. No successful method of treatment is known. It will help greatly in the control of the disease if the fruit canes are cut and burned as soon as the fruit is gathered. In making new settings the grower should use only plants from healthy patches.

Crown-gall, or root-knot

This is a bacterial disease that is often destructive, particularly to the red varieties. It is detected by the large, irregular knots on the roots and at the crown underground. The disease is contagious.

Control.— The grower should avoid planting on infested land, and should never set plants showing the root-knots. Other than these two precautions, no effective method of treatment is known.

Red-rust

The fungous disease known as red-rust, or yellows, is often serious on both the black and the red varieties. In some sections of New York it has made the crop unprofitable, while in other sections it is not found at all.

Control.— As soon as the disease appears in the patch the affected plants should be rooted up and burned immediately, making sure that all the roots are removed. If the disease is to be successfully checked this method of eradication must be carefully carried out.

INSECTS INJURIOUS TO RASPBERRIES

The two insects that are injurious to the raspberry are briefly described below and the methods of their control are given. These descriptions are taken directly from the same sources as are those of the diseases.

Sawfly

The adult flies are black, with a dull reddish spot in the middle of the abdomen above. They are about the size of the house-fly, but are narrower in shape and have four wings. The eggs are inserted into the tissues of the leaf and a small brown patch appears on the leaf above each egg. The eggs hatch after about a week. The larvæ, which are greenish in color and covered with rows of spines, feed on the tender leaves in spring. They become full-grown by July, when they fall to the ground and spin small cocoons beneath the surface of the soil.

Control.— The insect is controlled by the application of weak solutions of paris green or arsenate of lead, but these poisons should not be used after the fruit is formed. Hellebore may be substituted, as this loses strength rapidly after being applied. It may be dusted over the bushes or steeped in water and sprayed on.

Cane-borer

The adult is a slender beetle, with black wing covers and a yellow thorax. In laying her eggs the female girdles the tip of the cane with rings of punctures. These rings are separated from one another by about an inch. Between the rings the female pierces the cane and forces into it a long, light-colored egg. Immediately after this girdling, the tip of the cane droops and soon dies. The egg hatches in a few days and the young larva burrows down the center of the stem, consuming the pith. The larva passes the first winter in its burrow not far from where the egg was deposited, and by the second fall reaches the root, where it passes the winter and changes into a pupa the next spring. The beetles escape from their burrows in June, at which time they may be found on the bushes.

Control.— Soon after the female punctures the cane at the point where the eggs are deposited, withering and drooping of the tip is conspicuous. As soon as this is noticed the cane should be cut off well below the injury, so that there is no danger of leaving the grubs, which may have hatched before the injury is noticed.

CORNELL STUDY CLUBS

Often several persons in a community desire to undertake reading that will help them conduct their farming operations to better advantage. Readers who have found the lessons of the Reading-Course to be of assistance to them may invite others to join the course. The demand for Reading-Course lessons has increased rapidly during the past year. In a number of communities, study clubs have been formed. If Reading-Course lessons can be studied in a group there is added interest and a better opportunity for self-expression, resulting often in mutual helpfulness among members of the group. Such study clubs may include men, women, and young persons, and may have social features as part of the programs for the meetings. The two Cornell Reading-Courses — the course for the farm and the course for the farm home — provide lessons of particular interest to both men and women. Study clubs may confine themselves to lessons in either course; or, if one club is composed of both men and women, the lessons in the two courses may be alternated, or two separate groups may be formed holding part of the program in common.

The organization of a club for the purpose of studying lessons for the farm can easily be effected even if at first only a few persons desire to

form a group. A meeting of those interested in Reading-Course lessons should be called at some convenient time and place, a president and secretary should be chosen, and the dates for meetings decided on. The president should be responsible for the success of the meetings and should act as presiding officer. The duties of the secretary will be to correspond regularly with the Supervisor of the Reading-Course for the Farm and to obtain lessons for distribution at meetings of the club. The lessons should be distributed one week in advance and the members urged to come to the meetings prepared to discuss the lessons. Speakers should be chosen who will present the subjects taken up in the lessons. Arrangements should be made far enough in advance of meetings to enable the speakers to obtain information on their subjects from as many sources as possible. On request special references for reading will be given by the Supervisor of the Reading-Course for the Farm. The meetings of a club should be held frequently enough to maintain an active interest in them; regularly every two weeks during the fall and winter is usually considered sufficiently often. If it is not advisable to meet every fortnight in spring and summer, monthly meetings are suggested. The meetings should proceed under a definite order of business.

The interest shown in a study of Reading-Course lessons for the farm will depend largely on whether the lessons are related to local agricultural conditions and whether they deal with operations in progress at the time of year in which they are being discussed. It would be well for each club to choose its own lessons for study. Before the first meeting a list of available lessons should be obtained. If appropriate lessons are not available, the Supervisor of the Reading-Course for the Farm will help the secretary of the study club to obtain suitable bulletins as far as possible.

Whenever desired, study clubs may be conducted in connection with the educational work of granges, churches, schools, and local agricultural societies. The following three ways are suggested in which Reading-Course lessons may prove valuable to a study club or to any other organization:

1. For study by the entire membership previous to a general discussion at a regular meeting.

2. By speakers in preparing for a program at a regular meeting.

3. For reference. A set of available lessons may be obtained for use by a study club or for the library of any church, school, grange, or recognized agricultural organization.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 36 | ITHACA, N. Y. MARCH 15, 1913 | FRUIT-GROWING SERIES No. 3

CULTURE OF RED AND BLACK RASPBERRIES AND OF PURPLE-CANE VARIETIES

DISCUSSION PAPER

A supplement called a discussion paper is sent with each Reading-Course lesson with a view of assisting the reader to examine and improve his methods of farming. The discussion paper also aids in reviewing important points in the lesson. The answering of the questions is optional, but a majority of readers accept this opportunity for additional work. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, VEGETABLE-GARDENING, PLANT-BREEDING. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to continue to receive Reading-Course lessons should sign and return the discussion paper sent with each lesson.* Each discussion paper returned will be read over carefully and a personal reply will be made when help can be given. The Reading-Course will endeavor to aid in the solution of farm problems and in the organization of Reading-Course clubs, and to give references for advanced study. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.*

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

1. How would you get a new red or black raspberry bush from old bushes of these fruits?

2. In what respects does the pruning of the red raspberry differ from that of the black?

3. Which of the raspberries do the purple-cane varieties resemble in color of fruit? in manner of growth?

4. Do you grow cover-crops between the rows of berries? If so, what crops and with what success?

5. Do you fertilize with manure or with commercial fertilizers, and how and when do you make the applications?

6. Is hardiness a factor of prime importance in growing raspberries in your section?

7. What varieties of these fruits succeed best in your section?

8. What are the approximate yields that you obtain from these varieties?

9. What are the most serious diseases and insect pests of the raspberry in your section, and how do you control them?

Name ....

Address ....

Date ....

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 38 | ITHACA, N. Y. APRIL 15, 1913 | PLANT-BREEDING SERIES No. 1

PRINCIPLES AND METHODS OF PLANT-BREEDING*

C. H. MYERS

The possibility of breeding plants was not wholly unknown to the ancient peoples. One of the Latin poets showed familiarity with the idea when he wrote the verses:

> "Still will the seeds, though chosen with toilsome pains,
> Degenerate, if man's industrious hand
> Cull not each year the largest and the best."

FIG. 74.—*Individual rows of wheat*

It must not be supposed, on the other hand, that the breeding of plants was well understood. Long after the breeding of animals had become an established practice, the field of plant-breeding remained unexplored,

*Paper No. 34, Department of Plant-breeding, Cornell University, Ithaca, New York.

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probably because the sexes are less clearly differentiated to the casual observer. Until recent years, plant-breeding had not been dignified as a subject for scientific study. Such investigation has shown that the same principles of evolution and heredity apply to both plants and animals, and that "good blood" tells in corn as well as in cows. At the present time the breeding of plants is being presented in some fifteen institutions, and definite instruction is received by one thousand to fifteen hundred students.

Every organism is the product of two factors, environment and heredity. Environment means home conditions or surroundings. In the case of plants, this includes soil, climate, and care. Heredity means the transmission of similar characters from one generation to another. It is only by giving attention to both these factors that the maximum yield of crops can be produced. The environment must be good, that is, the soil must be kept in good condition by fertilization and cultivation. It is not the purpose of this pamphlet, however, to discuss that part of the question, but rather to emphasize the factor of heredity.

A great demand for conservation of resources has been sweeping over the country during the past decade. At first the conservation movement dealt mainly with the forests and the water power. Recently it has included the conservation of the soil and mineral resources. The writer believes that this movement should be further enlarged to include the conservation and propagation of high-yielding strains of plants.

Many may think that the breeding of plants is a complex task, as compared with the breeding of animals. This is not true. The laws and principles that apply to animal-breeding apply also to plant-breeding, and one who understands the breeding of stock should be able to apply this knowledge to the improvement of plants.

The plant-breeder has several advantages over the animal-breeder. In the first place, he can handle much larger numbers. He is able to discard undesirable types of plants more easily than the stock-breeder can discard "scrub" animals. In crossing, he can control the matings more closely.

METHODS OF BREEDING

There are two general methods used in the breeding of plants: first, hybridization, and second, straight selection. It is sometimes difficult to separate these two processes, for selection is practiced to isolate and preserve both forms already existing and those that may be produced by hybridization. Sometimes the terms breeding and selection are considered to imply two different processes, but selection is merely one of the methods of breeding.

Hybridization

Among the higher plants, as well as animals, every individual is the product of the fusion of germ cells from two parents. In other words, plants have sex and are possessed of female organs and male organs. The latter consist of the filaments and anthers of flowers, while the former consist of the style and stigma. The floral parts of timothy shown in Fig. 75 will serve our purpose as an illustration. The anthers produce pollen, which is the male element. Some of this pollen falls on the stigma, and from there it is conducted through the style to the ovary or female element, where fertilization takes place. Fertilization means the process in which the male element unites with the female element. As a result of this union a new individual is formed, or, rather, a seed is formed which will develop into a new individual. This new individual contains the characters of both parents to a certain extent. The process of crossing one plant on another plant of a different variety or strain is called hybridization.

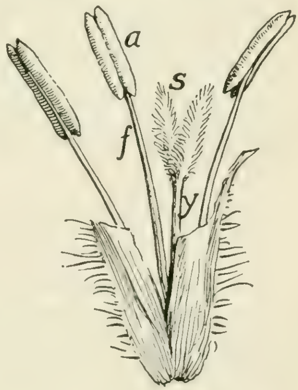

FIG. 75.— *Drawing of a timothy flower, showing the floral parts: a, anther; f, filament; s, stigma; y, style*

It has been found that these characters behave in a definite way, according to Mendel's law.* According to this law, characters behave as units, or single items. The term "unit characters" is often applied in this connection. The character of every individual plant or animal is represented in the germ cell by a small unit. This must be true, since offspring do possess the characteristics of the parents, although nothing except the germ cell is handed on from the parent to the offspring. This law of Mendel includes the laws of dominance, segregation, and recombination of characters, terms which will now be defined.

Mendel's law may best be explained, perhaps, by referring to the experiments that Mendel himself performed. He worked with a tall variety and a dwarf variety of the common garden pea. When he crossed a tall pea with a dwarf, all the plants resulting from this cross were tall. When the seed from these tall plants was planted, it produced both tall and dwarf plants in the ratio of three tall to one dwarf. When the seed from these last tall and dwarf plants was planted, the third year of the experiment, one third of the tall plants produced tall plants; the other

* This law was formulated by Gregor Mendel, an Austrian monk, in 1865, but remained unnoticed until 1900, when it was rediscovered by three men at almost the same time.

two thirds produced talls and dwarfs in the original ratio of three of the former to one of the latter. All the dwarf plants produced only dwarfs.

In this particular experiment two unit characters were considered, namely, tallness and dwarfness. The first is the dominant character; the second is the recessive. When these characters are possessed by two different plants that are crossed, the first generation after the cross will contain both of them. Owing to its dominance, only the character of tallness seems to be present. The recessive character, dwarfness, is submerged or hidden, but appears in the second generation after crossing, in one fourth of the individuals. This appearance of the recessive along with the dominant is what is meant by segregation. The reader must not think that segregation occurs always in the *exact* ratio of three to one. Perhaps it never comes out numerically exact. But if a large number of individuals are grown, on the average the ratio will approximate three of the dominants to one of the recessives.

For the sake of simplicity, the writer has used only the two characters of peas to explain dominance, recessiveness, and segregation. It has been worked out with innumerable plant characters since Mendel's time, as well as with many animal characters. In the following list, which contains only a few of the many examples that might be drawn upon, the dominance for each pair of characters has been definitely determined. In each case the dominant character is given first.

1. Tallness and dwarfness. Peas
2. Rounded and wrinkled seed. Peas
3. Yellow and green seed. Peas
4. Smooth and bearded heads. Wheat
5. Long and short staple. Cotton
6. Susceptibility and resistance to rust. Wheat
7. Starchy kernels and sugary kernels. Corn
8. Yellow kernels and white kernels. Corn

The reader's attention is directed especially to number 6 in the list. Here it is evident that susceptibility and resistance to disease behave as unit characters. This fact was discovered by Professor Biffen of England, who has done considerable work with wheat.

The practical man may wonder of what service Mendel's law may be, if various characters of plants and animals brought together in a hybrid merely separate according to a definite ratio in the second and following generations. A few words of explanation may be helpful. In addition to ordinary segregation, there may occur a recombination of characters.

This can best be explained by an example. A tall, green-seeded pea is crossed with a dwarf, yellow-seeded variety. In the second generation after the cross, not only does the expected segregation of tall greens and dwarf yellows take place, but also novelties appear in the form of dwarf greens and tall yellows. There has accordingly been a recombination of the unit characters: tallness becomes linked with the yellow color; dwarfness with the green color. From such recombinations the practical benefits are derived.

A large amount of work has been done on the problem of Mendelism. The brief explanation presented aims to give some notion of the intricate combinations that may arise from crosses. Ordinarily, hybridization requires too much time and attention to be practiced by the farmer. The production of new varieties by this process will have to be left largely to scientific men. The practical man can accomplish most by the use of the second method of breeding, namely, straight selection.

Straight selection

Variability the basis of selection.—No two persons are exactly alike. Although in general structure there is more or less similarity, individual characteristics and personalities differ. We learn to recognize persons by their differences, not by their likenesses. Such variability is common to all plants and animals, and is the basis of selection. Without variation nothing could be accomplished. In order to study variation, individuals must be observed. The differences are not apparent by a casual observation of a general population.

There are two kinds of variations, to which have been given the names "fluctuations" and "mutations."

Fluctuations.— Variations of this kind are sometimes called quantitative or continuous variations. They are called quantitative because they conform to certain mathematical principles. If an ear of corn that measures exactly 10 inches in length is planted, the offspring are not all of that length, but will range, perhaps, from 7 to 13 inches. If the kernels from a head of wheat that measures 9 centimeters in length are planted, the offspring do not all have heads 9 centimeters long, but may range in length from 6 to 12 centimeters.

The following tables (Figs. 76 and 77), called distribution tables, represent some of the practical results derived from such study. They furnish an excellent means for explaining fluctuations, as well as other matters that will be referred to later in this lesson.

In Fig. 76 * is shown the distribution in length of 327 ears of corn, whose seed came from 10-inch ears. It will be seen that these ears ranged in length from 3 inches to 12 inches, the greatest number being 9 inches

CLASSES	FREQUENCY
3.0	1
3.5	0
4.0	1
4.5	0
5.0	2
5.5	3
6.0	9
6.5	8
7.0	12
7.5	19
8.0	32
8.5	40
9.0	67
9.5	63
10.0	38
10.5	21
11.0	8
11.5	2
12.0	1
	327

FIG. 76.— *Distribution table. Length of ears of corn, measured in inches*

long. The gradual decrease in frequency on either side of the 9-inch class should be noted.

In Fig. 77 is shown the distribution in length of 317 heads of wheat. These 317 heads were not descended from heads of a certain length, but represent a population of wheat and show the fluctuating variability.

* Davenport, Eugene. Principles of Breeding, p. 421.

CLASSES	FREQUENCY
11.5 – 11.0	1
11.0 – 10.5	0
10.5 – 10.0	5
10.0 – 9.5	13
9.5 – 9.0	56
9.0 – 8.5	96
8.5 – 8.0	83
8.0 – 7.5	37
7.5 – 7.0	19
7.0 – 6.5	4
6.5 – 6.0	2
6.0 – 5.5	1
	317

FIG. 77.—*Distribution table. Length of heads of wheat, measured in centimeters*

A glance at Fig. 77 shows that these heads ranged in length from 6 centimeters to 11.5 centimeters, the greatest number occurring in the group, or class, between 8.5 centimeters and 9 centimeters in length. Here again will be noted a gradual decrease in frequency on either side of this group.

Fluctuations are not inherited, that is, they are not handed down from parent to offspring. It has been shown that ears which came from parents measuring 10 inches were not all 10 inches long. In fact, there were more ears 9 inches in length than any other. The *type* of those ears, in regard to length, was 9 inches. If fluctuations are not inherited, they cannot be of especial value to the breeder. Even though we select an individual that is in advance of or below the type, it will not produce progeny all of which are like itself. It is not known what effect a long-continued selection of this kind will have, but as yet there is no evidence to prove that it will change the type.

Mutations.— The other kind of variation, called mutation, is of the most importance to breeders. Mutations are sometimes called sports or discontinuous variations. They are striking, and are different from the plants among which they have their origin. Mutations are of practical use because they are inherited. This does not mean that all the offspring of a mutation are exactly like the parent. The offspring, if arranged in a distribution table, will show fluctuating variability just as the parent family did; but the type will be different. A mutation always establishes a new type. For example, in Fig. 76 the type of the ear as to length was 9 inches. If a mutation should occur in that particular strain of corn, the type would be changed to, possibly, a 10-inch ear, although there would be a distribution on either side of the type just as there was in the ears arranged in Fig. 76. No one knows what causes mutations to appear. If they could be produced at will, the process of breeding would be greatly advanced.

The Cupid sweet pea is one of the most striking examples of mutation. It appeared in a pure variety of Emily Henderson, which is a tall-growing variety. The dwarf plant suddenly appeared one year and has continued true to its type. Most of our double flowers owe their origin to mutation. A large number of varieties of tomatoes also originated in this manner.

The same form of mutation may occur again and again in a group of plants. The thornless cactus is an example of this. Smooth branches often occur on thorned trees. This form of mutation is known as bud mutation. The haw tree is rich in such mutations.

Without doubt many of our famous breeds or races of animals owe their origin to some ancestral mutation. There are those who think the

Morgan horse was a result of mutation, and it is definitely known that a large part of racing stock may be traced back to one exceptional, original parent. It is not unreasonable to suppose that some of our great families, in the human race, may have originated in this way. Farmers should be always on the lookout for these striking forms of variation. Mutations are constantly occurring among plants, but they cannot be made of use unless some one observes and saves them.

Methods of selection

There are two methods of selection that have been used. The first of these is mass selection and the second is individual selection. Both these methods are in use, although the first method is not nearly so good as the second.

Mass selection.— Mass selection is probably the method used most by farmers. It consists, usually, of a selection of good-looking individuals, without special regard to the performance record of the parent plants. Individual performance records cannot be obtained because the seed from these individuals is mixed together " in a mass " and then sown. Sometimes it is sown in a part of the field set aside for seed purposes and is given special care and attention. The plants from this seed represent many different families. The plant-breeder calls them strains, or types. Some of these strains, or types, are good yielders, others are medium, and still others are poor. In fact, there are all gradations of excellence. By practicing mass selection persistently, the poorer types may gradually become eliminated and the better types left. This process would take years, however, and in many instances would be doubtful of accomplishment even then. Isolation and conservation may be accomplished much more readily by individual selection.

Individual selection.— It has been said that there is always variation among plants, that no two plants are exactly alike although they may belong to the same species. There are families of plants just as there are families of people; not the families of which the botanist speaks, but the types and strains of the plant-breeder. Every plant possesses its own individuality or characteristics. These characteristics are of the type, or strain, to which the plant belongs. It is by a study of individual plants that these different type traits can best be noted and conserved. This is what is meant by individual selection. Thus we have "ear to row," "head to row," and "tuber unit" methods of conducting breeding plots.

The " ear to row " method in corn furnishes a means for testing the individual capacities of ears of corn. The same number of kernels from each of one hundred ears are planted in one hundred separate rows. The rows are all of the same length and are treated as nearly alike as possible.

Any differences that may occur must be due to the individuality of the different ears. Such a test is most interesting, and the individual variations are striking. Some rows will be tall, others short; some will bloom early, others late; some will have broad leaves, others narrow; and all the plants of each row will be typical of that row. The most interesting and practical variation, however, will be the yield that is produced by the different rows (Fig. 78). Some will yield a great deal more than others, and yet they all had equal chances and the original parent ears, as far as could be determined by observation, were equally good. The following list of yields was selected at random from such a breeding plot.

FIG. 78.—*Inspecting a neighbor's corn-breeding plot*

There is a difference of twenty bushels between the lowest and the highest yield.

70 bushels per acre
73 bushels per acre
80 bushels per acre
76 bushels per acre
69 bushels per acre
89 bushels per acre
87 bushels per acre
73 bushels per acre
78 bushels per acre

Naturally, the seed should be saved each year from those rows that give the highest yields, because they represent the high-yielding types or strains. When such a corn-breeding plot has been conducted for a period

of four or five years, interesting results are to be observed. Descendants of only three or four of the original ears will be represented in the breeding plot at the end of that time. The others will drop out. It would seem that our best strains of corn descend from especially striking ancestors, just as breeds of stock or single herds contain almost exclusively the blood of some exceptional progenitor. It would take many years to accomplish such a result by mass selection. Mr. Reid spent practically his whole lifetime in producing the Dent corn which bears his name. He might have accomplished his purpose in much less time had he practiced individual selection.

The method of individual selection can be applied to any crop; the principle is always the same. Some unit, such as head, plant, or tuber,

FIG. 79.—*Harvesting individual rows of oats*

is taken as the basis, planted in such a manner that the comparison of the individuals may be easy, and the seed kept separate (Fig. 79). It is true that difficulty arises with some plants, such as corn, because of cross-pollination. This difficulty is not serious from a practical standpoint and is not to be considered in many of our crops, such as oats, wheat, rye, barley, peas, beans, potatoes, and other plants that are either self-fertilized or are propagated by cuttings. A leading authority on plant-breeding has said that, as far as our cereals are concerned, there are enough different types, already existing, to supply almost any demand that may be made. It is unnecessary to resort to hybridization. It is only necessary to examine a large enough number of individuals to find the desired one.

The question of numbers is very important. One should not start with too few, but should grow as many plants as possible. In the case of corn, wheat, or oats, for example, it would be unwise to begin with less than 50 heads or ears. If the crop is potatoes, surely not less than 200 tubers should be in the first choice. If a large number of individuals is chosen for the beginning, the chance of finding more desirable types is correspondingly greater.

A complicated system of records, with the pedigree of every plant grown, is unnecessary. The scientific man should keep such records for the purpose of studying principles which may be put to practical use. After the farmer has obtained a type, or strain, of plants superior in comparison with others, he needs only to increase the seed of that strain, protecting it if necessary from mixtures, until he has enough for his whole farm and perhaps a surplus to sell. There is an ever-increasing demand for well-bred seed of all crops.

It is remarkable, too, how rapidly seed can be increased from a small beginning. A single head of wheat may yield 150 to 200 bushels within three years time. The farmer should take advantage of this generous quality of nature. Seed selected from important crops will yield an abundant increase in a surprisingly short time, and the yield of crops on the farm will be materially increased by the use of highly bred seed.

BIOMETRY

The writer has said that it is not necessary for the practical man to keep a complicated system of records. It is desirable, however, that he have some means of sizing up the situation in order to determine variation and type and to see what progress he is making. For this purpose the breeder, both of plants and animals, has had to call on the mathematician for help. As a result of this, a subject called biometry has been developed. The term means measure of life. To go into this subject deeply would require special training. But there are some practical uses to which it can be applied with but little study, no more, indeed, than is needed to run a new type of farm implement.

To determine amount of variation

It might be supposed, for example, that a farmer is selecting corn rather carefully, paying especial attention to length of ears. He should proceed by measuring a random sample of 300 to 500 ears of each crop, arranging the results in a distribution table as shown in Fig. 76. If one person measures the ears and another makes the marks in the proper square, the task is comparatively short.

The first column of figures to the left, in Fig. 76, represents the different lengths of ears. These different lengths are called *classes*, and in this instance they differ by one half inch each. The last column to the right contains the *frequencies*. These are the total number of individuals which are grouped in each class.

In the above table there is a fairly wide range of variation. The extremes range from 3 inches to 12 inches. This indicates a fair amount of variability. In other words, this particular "population" of corn was not especially uniform. There are mathematical ways of calculating exactly this amount of variation, but for practical purposes these are not necessary.

To determine type

What does a breeder mean when he speaks of type? His idea of type is usually the standard which he has in mind. It is his ideal toward which he is selecting. The ideal type should not be confused with the actual type. The distribution table furnishes him a way to know exactly what the actual type is as well as to know how nearly he is approaching his ideal type, which we have called his standard. An inspection of Fig. 76, shows that the greatest number of ears were 9 inches long. In other words, the actual "type" or "mode" is 9 inches. This is considered the best measure of type. It is important to know what percentage of the population conforms to the type. To find this, divide the number of individuals at the mode by the total number of individuals. In this particular instance it is $67 \div 327 = 20.5$. This is called the modal coefficient. For this population of corn, 20.5 per cent of the individuals conformed to the type.

To measure progress

There is another coefficient which is of use to the practical man, called the standard coefficient. In this case the breeder might be selecting for a 10-inch ear. To determine what proportion of the individuals conform to his standard, divide the number of individuals in the 10-inch class by the total number. The standard coefficient, then, in this case, is $38 \div 327 = 11.6$. In this instance, 11.6 per cent of the individuals conformed to the standard of the breeder. If this coefficient increases from year to year he knows that he is progressing. If it remains the same his selection is of no avail.

The method of measuring variation, type, and progress that has here been explained can be applied to numerous characters of any crop. To those who care to make such investigation, it will prove interesting and valuable.

THE CORNELL READING-COURSE FOR THE FARM

In order to assist those who desire to learn but are unable to leave their work, a Reading-Course for the Farm is offered free to residents of this State. This course is conducted by means of printed lessons dealing with practical agricultural problems. Certain lessons discuss fundamental principles which should be understood by those who wish to farm most successfully; others contain concrete suggestions or give detailed directions for the best practices. New lessons are published each month, thus making it possible for the Reading-Course to present the latest ideas on agriculture.

Reading-Course Lessons for the Farm are grouped in series, each series taking up a farming enterprise. On the last page of this lesson is given a list of the present series together with available lessons in each. Lessons in any series are sent one at a time so that the reader may give them careful attention and receive consecutive information. When the reader returns the discussion paper accompanying each lesson another lesson in the series is sent. This plan is continued until the reader has received all the available lessons in the series. He is then supplied with references for advanced reading if desired and is registered for future publications on the subjects of interest. The Reading-Course aims to encourage the reading of reliable agricultural literature.

CORNELL STUDY CLUBS

Often several persons in a community desire to undertake reading that will help them conduct their farming operations to better advantage. Readers who have found the lessons of the Reading-Course to be of assistance to them may invite others to join the course. The demand for Reading-Course lessons has increased rapidly during the past year. In a number of communities, study clubs have been formed. If Reading-Course lessons can be studied by a group there is added interest and a better opportunity for self-expression, resulting often in mutual helpfulness among members of the group. Such study clubs may include men, women, and young persons, and may have social features as part of the programs for the meetings. The two Cornell Reading-Courses — the course for the farm and the course for the farm home — provide lessons of particular interest to both men and women. Study clubs may confine themselves to lessons in either course; or, if one club is composed of both men and women, the lessons in the two courses may be alternated, or two separate groups may be formed holding part of the program in common.

The organization of a club for the purpose of studying lessons for the farm can easily be effected even if at first only a few persons desire to form a group. A meeting of those interested in Reading-Course lessons should be called at some convenient time and place, a president and secretary should be chosen, and the dates for meetings decided on. The president should be responsible for the success of the meetings and should act as presiding officer. The duties of the secretary will be to correspond regularly with the Supervisor of the Reading-Course for the Farm and to obtain lessons for distribution at meetings of the club. The lessons should be distributed one week in advance and the members urged to come to the meetings prepared to discuss the lessons. Speakers should be chosen who will present the subjects taken up in the lessons. Arrangements should be made far enough in advance of meetings to enable the speakers to obtain information on their subjects from as many sources as possible. On request special references for reading will be given by the Supervisor of the Reading-Course for the Farm. The meetings of a club should be held frequently enough to maintain an active interest in them; regularly every two weeks during the fall and winter is usually considered sufficiently often. If it is not advisable to meet every fortnight in spring and summer, monthly meetings are suggested. The meetings should proceed under a definite order of business.

The interest shown in a study of Reading-Course lessons for the farm will depend largely on whether the lessons are related to local agricultural conditions and whether they deal with operations in progress at the time of year in which they are being discussed. It would be well for each club to choose its own lessons for study. Before the first meeting a list of available lessons should be obtained. If appropriate lessons are not available, the Supervisor of the Reading-Course for the Farm will help the secretary of the study club to obtain suitable bulletins as far as possible.

Whenever desired, study clubs may be conducted in connection with the educational work of granges, churches, schools, and local agricultural societies. The following three ways are suggested in which Reading-Course lessons may prove valuable to a study club or to any other organization:

1. For study by the entire membership previous to a general discussion at a regular meeting.

2. To aid speakers in preparing for a program at a regular meeting.

3. For reference. A set of available lessons may be obtained for use by a study club or for the library of any church, school, grange, or recognized agricultural organization.

AVAILABLE READING-COURSE LESSONS FOR THE FARM, ARRANGED BY SERIES

Residents of New York State may register for one or more of the series mentioned below by addressing The Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, New York.

The following list is correct to April 15, 1913. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

SERIES		LESSONS
The soil	2	The soil: Its use and abuse
	42	The tilth and tillage of the soil (in press)
Poultry	4	Incubation.— Part I
	6	Incubation.— Part II
	10	Feeding young chickens
Rural engineering	8	Knots, hitches, and splices
Farm forestry	12	The improvement of the woodlot
	28	Recent New York State laws giving relief from taxation on lands used for forestry purposes
	40	County, town, and village forests (in press)
The horse	14	Horse-breeding to increase the farm income
Dairying	16	Practical dairy problems
	32	Composition of milk and some of its products
Fruit-growing	18	The renewal of the neglected orchard
	22	The culture of the currant and the gooseberry
	36	Culture of red and black raspberries and of purple-cane varieties
Farm crops	20	Alfalfa for New York
	24	The rotation of farm crops
Stock-feeding	26	Computing rations for farm animals
Vegetable-gardening	30	Hotbed construction and management
Plant-breeding	41	Improving plants by selection or breeding
	38	Principles and methods of plant-breeding

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 38 | ITHACA, N. Y. APRIL 15, 1913 | PLANT-BREEDING SERIES No. 1

PRINCIPLES AND METHODS OF PLANT-BREEDING

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper aids also in reviewing important points in the lesson. The answering of the questions is optional, but a majority of readers accept this opportunity for additional work. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read over carefully, and a personal reply will be made if information is requested.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, PLANT-BREEDING, VEGETABLE-GARDENING. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to receive the other lessons in this series should therefore sign and return this discussion paper whether the questions are answered or not.* The Reading-Course will endeavor to aid in the solution of farm problems and in the organization of study clubs, and to give references for advanced study. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.*

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

1. What are the two important factors in the growing of plants?

2. What is hybridization? How are crosses made?

3. Briefly explain Mendel's law, including the law of dominance, recessiveness, segregation, and recombination of characters.

4. What is the difference between mass selection and individual selection? Have you practiced either?

5. Discuss variation in plants. What are fluctuations? mutations?

6. What is meant by type? What is a standard coefficient? a distribution table?

7. Are you breeding any crops? If so, describe your method and tell of the success that you have had.

8. Is there a demand for high-bred seed in your community?

Name............................

Address..........................

Date...........................

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. Bailey, *Director*

Course for the Farm, Royal Gilkey, *Supervisor*

VOL. II. No. 40 | ITHACA, NEW YORK MAY 15, 1913 | FARM FORESTRY No. 3

COUNTY, TOWN, AND VILLAGE FORESTS

A. B. Recknagel

A new law for the acquisition and development of forest lands by counties, towns, and villages of New York State went into effect in March, 1912. The governing board of a county, town, or village may hereafter acquire by purchase, gift, lease, or condemnation, tracts of land having forests or tree growth thereon or suitable for the growth of trees.

This opens up a new phase of forest management in New York State. There are already national forests created from the public domain, or, more recently, by purchase of land at the headwaters of navigable streams. These national forests are controlled and administered by the Federal Government through its Department of Agriculture. Forest reservations are owned and administered by many of the States, also, such as the state forest preserves in New York. But most of the forested area of this country is owned privately or corporately. In New York State there are large areas of unproductive land, yielding little or nothing in taxes, which could be made productive. Such lands are well suited to become county, town, or village forests that will substantially decrease taxes and will keep up the roads.

To the private owner the forest is primarily a source of immediate gain. To the nation or state it is more than this — it is a safeguard for the prosperity of future generations, a prosperity dependent to no small degree on the proper conservation of forests. The law making possible the acquisition of lands for forestry purposes by counties, towns, and villages, is therefore a further step toward the goal of nation-wide conservation of natural resources.

Conservation means not the locking-up of resources but the using of them without abusing them. It emphasizes the management of forests in such a manner that they will continuously produce timber and other forest products without impairing their protective function.

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, New York, under the Act of Congress of July 16, 1894.

PROVISIONS OF THE LAW

The law gives the counties, towns, and villages of New York State an opportunity to own and administer communal forests, deriving therefrom a perpetual income from the sale of timber and all the

FIG. 80.— *The timber crop*

safeguards of a forest cover. Such safeguards are not to be discounted; they include the regulation of the run-off of streams, the prevention of snow-slides and earth slides, shelter from winds, protection to birds, game, and fish, and a beautiful and healthful playground for old and young. All these benefits are now within reach of every county, town, and village in the State of New York, provided it comply with the law.

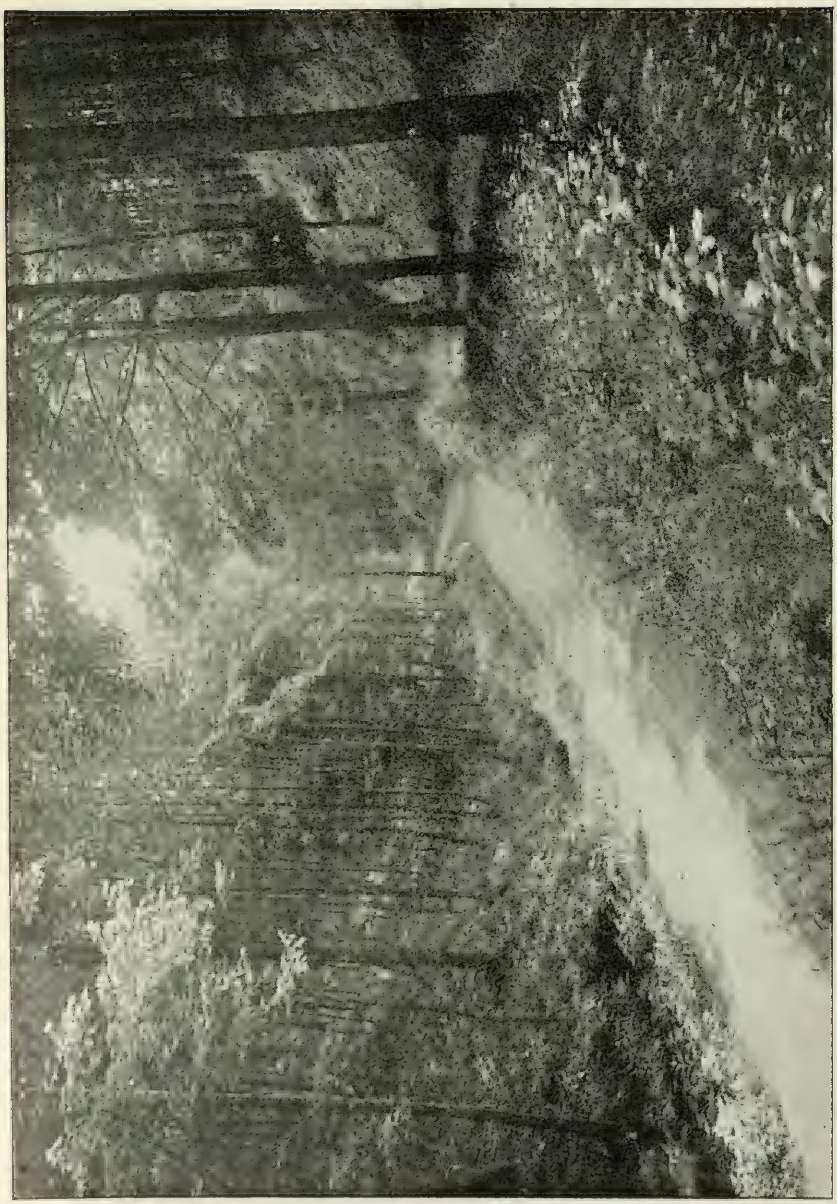

FIG. 81.— *This land is better suited for growing timber than for cultivated crops*

FIG. 82.—*A forest cover protects steep slopes*

The principal points in the law are summarized below, together with some suggestions as to their application. The complete text of the law is then given for the use of those who wish further details. Finally, a typical instance of a communal forest in Europe is cited, in order to show the possibilities opened up by the new law.

Lands to be developed

The lands acquired by counties, towns, and villages as forests shall be developed and used for the planting and rearing of trees thereon according to the principles of scientific forestry. They shall be administered for the benefit and advantage of the county, town, or village. Moneys may be appropriated for the care and maintenance of the lands so acquired and for the development and use of the forests thereon, the necessary amounts to be raised by taxation in the same manner as for other expenditures of counties, towns, or villages.

This provision of the law enables the intelligent development of forest land acquired by a county, town, or village. It enables the carrying-out of a plan of management, a working plan prepared by a specially trained forester. If the tract is of sufficient size a resident forester is desirable; otherwise, periodic visits of a technically trained forester will suffice. The local organization must depend, of course, on the size of the forest and the character of the work to be done. Responsibility for the correct development of the tract should in no case, however, be placed in the hands of laymen unfamiliar with the science of forestry, although laymen could and should be employed in carrying out the directions of the forester in charge.*

How land is acquired

After the governing board has determined by resolution to acquire lands under the law, public notice is given by publication in an authorized newspaper for at least two weeks. The board shall give a hearing to all persons appearing in support of, or in opposition to, such proposed resolutions. After the purchase of such lands has been authorized, the necessary moneys may be raised by taxation or by the issuance and sale of county, town, or village bonds, as the case may be.

Object of the forests

All revenues from the lands shall be used for the reduction of taxation in the municipality concerned. The principal object, therefore, is the sale of forest products in aid of public revenues, and the protection of the water supply of the municipality.

* The Department of Forestry of the New York State College of Agriculture at Cornell University will be glad to assist and advise in the management of county, town, and village forests.

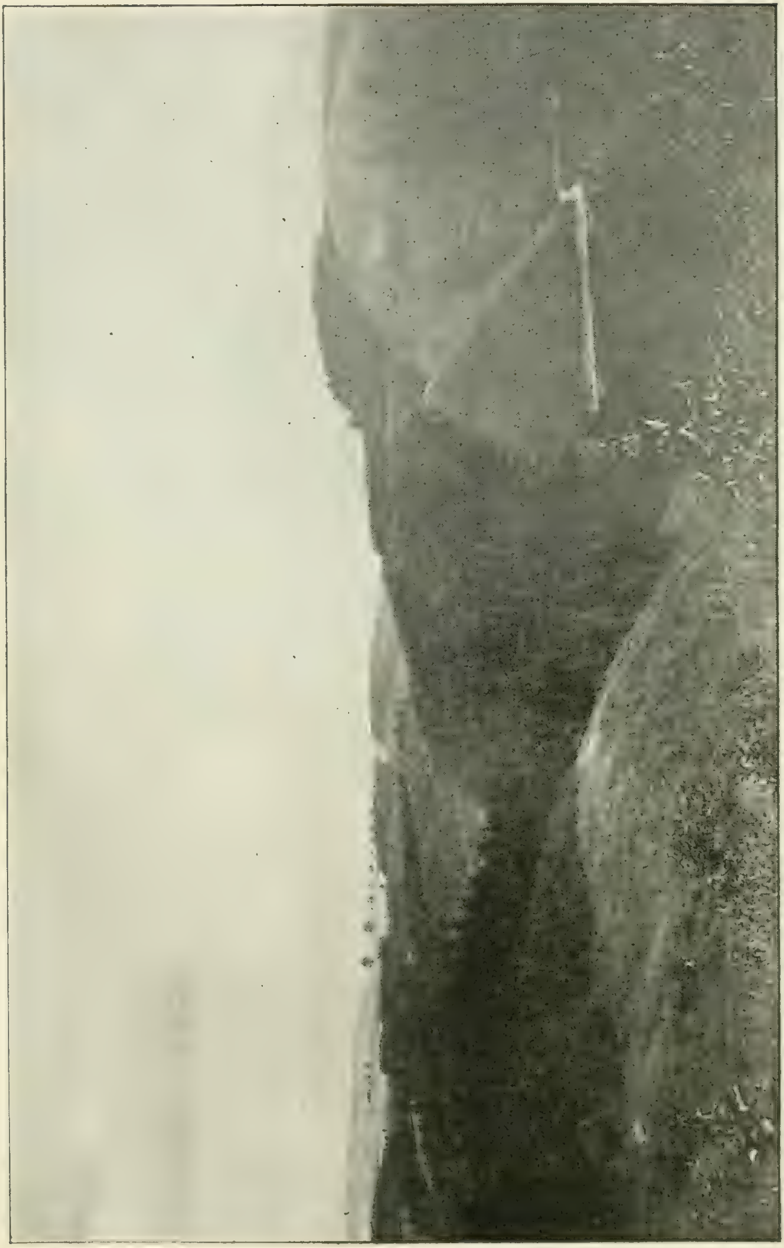

FIG. 83.— *Forests in the foreground, farms in the background. The forest is made up of old, young, and middle-aged timber in definite blocks. The road runs out of a block of nearly mature trees into the open, where young trees have replaced the old stand*

Disposal of the forests

The forests shall be subject to such rules and regulations as the governing board of the municipality shall prescribe. The land or parts thereof may be sold or leased on the adoption of a resolution to this effect by two thirds of all the members of the governing board, but such resolution is not effectual unless adopted after a public hearing similar to that preceding the acquisition of the land.

FULL TEXT OF THE LAW

Laws of New York.— By authority

Chap. 74

AN ACT to amend the general municipal law, in relation to the acquisition and development of forest lands by counties, towns and villages.

Became a law March 26, 1912, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Chapter twenty-nine of the laws of nineteen hundred and nine, entitled "An act relating to municipal corporations, constituting chapter twenty-four of the consolidated laws," is hereby amended by adding thereto, after section seventy-two, a new section, to be section seventy-two-a, to read as follows:

§ 72-a. **Acquisition and development of forest lands.** *The governing board of a county, town or village may* severally *acquire* for such county, town or village, *by purchase, gift, lease or condemnation, and hold as the property of such municipality, tracts of land having forests or tree growth thereon, or suitable for the growth of trees,* and *may appropriate therefor the necessary moneys of the county, town or village for which the lands are acquired.** Such lands shall be under the management and control of such board and shall be developed and used for the planting and rearing of trees thereon and for the cultivation thereof according to the principles of scientific forestry, for the benefit and advantage of the county, town or village. The determination of any such board to acquire lands under the provisions of this section shall be by resolution; but the question of the final adoption of such resolution shall be taken up by the board only after public notice thereof has been published for at least two weeks, as follows: If it be a resolution of a board of supervisors, the publication shall be made in the newspapers in which the session laws and concurrent resolutions are required to be published; if it be a resolution of a town board or of a board of trustees of a village, the publication shall be made in a newspaper published in the town or village, respectively. The board shall give a hearing to all persons appearing in support of or in opposition to such proposed resolution. If it be determined to purchase such lands the moneys necessary therefor may be provided as follows: If the acquisition be by a county, the board of supervisors may cause such moneys to be raised by taxation and levied and collected as other county taxes or may borrow money therefor on the credit of the county by the issuance and sale of county bonds in the manner provided by law for the issuance and sale of other county obligations; if the acquisition be by a town, the moneys necessary therefor shall constitute a town charge and be raised by taxation as other town charges, or, the town board may in its discretion, cause town bonds to be issued and sold in the manner provided by law for the issuance and sale of town bonds, under the town law, to pay judgments; if the acquisition be by a village, the moneys therefor may be raised by taxation, as other village taxes, or by the issuance and sale of village bonds in the manner provided by the laws governing such village relating to village obligations, after the adoption of a resolution therefor by the board of trustees, with-

* The author of this lesson is responsible for the italics.

out other authorization. All revenues and emoluments from lands so acquired shall belong to the municipality and be paid to its chief fiscal officer for the purposes of such municipality and in reduction of taxation therein. Such forest lands shall be subject to such rules and regulations as such governing board of the municipality shall prescribe; but the principal object to be conserved in the maintenance of such lands shall be the sale of forest products in aid of the public revenues and the protection of the water supply of the municipality. Such lands or portions thereof may be sold and conveyed, or leased, if a resolution therefor be adopted by the affirmative vote of two-thirds of all the members of such governing board; but no such resolution directing an absolute conveyance shall be effectual unless adopted after a public hearing, held upon notice given in the manner required in the case of a resolution to acquire such lands. A deed of conveyance or lease of such lands, when authorized as aforesaid, shall be executed by the county treasurer of the county, supervisor of the town or pres-

FIG. 84.— *When some of the old trees are cut, the seedlings are given a chance to grow*

ident of the village by which the conveyance or lease is made. Moneys may be appropriated for the care and maintenance of such lands and the development and use of forests thereon annually, by the county, town or village, respectively, and the amount thereof raised by taxation in the same manner that other expenditures of such county, town or village are provided for by law.

§ 2. This act shall take effect immediately.

EUROPEAN EXAMPLE

An excellent example of a successfully managed communal forest is the woodland belonging to the city of Zurich in Switzerland. Altogether this city controls 2,840 acres of land, of which 2,560 acres are covered with timber and only 39 acres are unproductive rock slides. The forest

is located in the northern foothills of the Alps and stretches along the Sihl River for a distance of nearly five miles. It may be reached from Zurich in about half an hour by rail or in two and one half hours by wagon.

The Sihl valley has an approximate elevation of 1,600 feet above sea level. From the valley floor the wooded slopes rise rather steeply to the ridge-top elevation of nearly 3,000 feet. This is nonagricultural land, which would be comparatively unproductive were it not devoted to the growing of trees.

In the Zurich city forest eighty-six per cent of the trees are hardwoods —

FIG. 85.— *The Zurich city forest*

beech, ash, maple, and elm. The remaining fourteen per cent are conifers — pine, spruce, fir, and larch. The beech is the chief species.

By the gradual removal of mature trees, the seedlings are given light and room in which to grow and to replace the old stand. The average tree of this forest is considered to be mature at ninety years of age; that is, it has reached its prime. The choicest trees are consequently allowed to attain this age; defective and inferior trees are removed earlier by means of thinnings. Formerly, the chief aim of this forest was to produce fuel — this was before the advent of the railroads — and to this day 64 per cent of the income is from fuel wood; the lumber produced brings only 9.4

per cent of the income, ties and timbers only 4 per cent, and miscellaneous materials 22.6 per cent.

This forest has been controlled and managed by the city of Zurich since 1309. One family, the Baumanns, were represented on the ranger staff continuously from 1539 to 1843. At present there is one technical man in charge, assisted by one clerk in the office and six rangers in the woods.

The first systematic working plan for the larger part of this city forest was made in 1696, and the first modern working plan for the whole city forest in 1834. This means that since 1696 only as much wood as grew each year was cut; only interest on the capital was being utilized, not the capital itself. The forest has netted the municipality an average income of nearly $20,000 annually. The net income from all forest products has averaged as high as $8 per acre each year. From the entire city forest there can be obtained annually without diminution of the supply, 1,916 cords from final cuttings and 880 cords from thinnings, a total of 2,796 cords or a yield of about seven eighths (.866) of a cord per acre of forest each year.

CONCLUSION

It is hoped that the counties, towns, and villages in the State of New York will avail themselves of the opportunity now offered to acquire and administer forest lands as a source of revenue and of future timber supply, and as a protection from floods and other damage by the elements. It is too much to expect immediately such incomes as those obtained from communally-owned forests in Europe; but even as a source of revenue communal forests will be advantageous to communities in New York State, while at the same time they are providing a source of enjoyment and safety to the citizens. In the meantime the forest land will increase in value as settlement progresses and the large timber holdings now in private hands are cut over; for the National forests and the State forests will always be confined largely to the higher mountains where the question of watershed protection is paramount. The county, town, or village forests will take their place between these mountain forests and the privately owned forests, and, if properly managed, will form demonstration centers of effective forestry, standing as object-lessons to all who now waste their woodlands.

NOTE.—Figs. 81, 82, and 83 are from photographs by Director James W. Toumey of the Yale Forest School; Fig. 80 is from a photograph taken by the Forest Service, United States Department of Agriculture; Fig. 84 is from a photograph taken by Lincoln Crowell.

THE CORNELL READING-COURSE FOR THE FARM

In order to assist those who desire to learn but are unable to leave their work, a Reading-Course for the Farm is offered free to residents of this State. This is not a correspondence course in the ordinary sense, but a means of interesting readers in elementary agricultural subjects and important rural problems. It aims also to lead the reader to express his opinion on the different subjects and to discuss his own experience. This course is conducted by means of lessons which deal with practical agricultural problems. Certain lessons discuss fundamental principles which should be understood by those who wish to farm most successfully; others contain concrete suggestions or give detailed directions for the best practices. New lessons are published each month, thus making it possible for the Reading-Course to present some of the latest information available.

Reading-Course Lessons for the Farm are grouped in series, each series taking up a farming enterprise. On the last page of this lesson is given a list of the present series together with available lessons in each. Lessons in any series are sent one at a time so that the reader may give them careful attention and receive consecutive information. When the reader returns the discussion paper accompanying each lesson another lesson in the series is sent. This plan is continued until the reader has received all the available lessons in the series. He is then supplied with references for advanced reading if desired and is registered for future publications on the subjects of interest. The Reading-Course aims to encourage the reading of reliable agricultural literature.

ADVANCED READING

The Reading-Course lessons are designed merely to introduce the subject; they are elementary and brief, and are intended to arouse a desire for fuller knowledge along particular lines. The study of Reading-Course lessons should be introductory to the study of standard agricultural books and of the bulletins of the United States Department of Agriculture and the state experiment stations. The Supervisor of the Reading-Course will suggest, as far as possible, agricultural literature to meet the needs of any reader. Particular books or bulletins are recommended because they are thought to be of special interest to the reader in his individual study and not because they are considered superior to others on the same subject.

AVAILABLE READING-COURSE LESSONS FOR THE FARM, ARRANGED BY SERIES

Residents of New York State may register for one or more of the series mentioned below by addressing The Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, New York:

SERIES	LESSONS
The soil	2 The soil: its use and abuse
	42 Tilth and tillage of the soil (in press)
Poultry	4 Incubation.— Part I
	6 Incubation.— Part II
	10 Feeding young chickens
Rural engineering	8 Knots, hitches, and splices
Farm forestry	12 The improvement of the woodlot
	28 Recent New York State laws giving relief from taxation on lands used for forestry purposes
	40 County, town, and village forests
The horse	14 Horse-breeding to increase the farm income
Dairying	16 Practical dairy problems
	32 Composition of milk and some of its products
Fruit-growing	18 The renewal of the neglected orchard
	22 The culture of the currant and the gooseberry
	36 Culture of red and black raspberries and of purple-cane varieties
Farm crops	20 Alfalfa for New York
	24 The rotation of farm crops
Stock-feeding	26 Computing rations for farm animals
Vegetable-gardening	30 Hotbed construction and management
	34 Home-garden planning
Plant-breeding	41 Improving plants by selection or breeding
	38 Principles and methods of plant-breeding

The above list is correct to May 15, 1913. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 40 | ITHACA, N. Y. MAY 15, 1913 | FARM FORESTRY No. 3

COUNTY, TOWN, AND VILLAGE FORESTS

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. The answering of the questions is optional, but a majority of readers accept this opportunity for additional work. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if information is requested.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, PLANT-BREEDING, VEGETABLE-GARDENING. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to receive the other lessons in this series should therefore sign and return this discussion paper whether the questions are answered or not.* The Reading-Course will endeavor to aid in the solution of farm problems and in the organization of study clubs, and will give references for advanced study. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.*

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, N. Y., under the Act of Congress of July 16, 1894.

1. What is the purpose of the recent law regarding county, town, and viliage forests?

2. What are the opportunities for such forests in your section?

3. What would be the advantages of such forests in your section?

4. Would you be interested in a movement to establish a county, town, or village forest in your locality?

5. How is the land to be acquired?

6. How are the forests to be developed?

7. How is the money for acquisition and development of forests to be raised?

8. In whose charge should the actual management of the forest be placed?

9. How may the lands be disposed of?

10. What parallel can you draw between the Zurich city forest and a communal forest which might be established in your own neighborhood?

Name............................

Address............................

Date............................

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 42 — ITHACA, NEW YORK, JUNE 15, 1913 — THE SOIL SERIES No. 2

TILTH AND TILLAGE OF THE SOIL

ELMER O. FIPPIN

A good soil should provide a congenial place for the development of plant roots. It should be deep enough to permit their normal spread.

FIG. 86.— *Good tilth of soil.* (*Double sulky plow, an implement that is increasing in favor for level land*)

It should carry the right amount of water, maintain a satisfactory temperature, and have adequate ventilation. It should have a chemical nature that will be congenial to plant roots and to useful organisms in

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the soil, and should supply the food required for plant development. These conditions should be maintained as evenly as possible. Not only are changes injurious in themselves, but one unfavorable condition will induce another.

That layer of soil in which the roots of plants are distributed and in which all the physical, chemical, and biological processes are most active is termed the root-zone. (Fig. 87.) For crops most commonly grown the root-zone should have a depth of at least three feet.

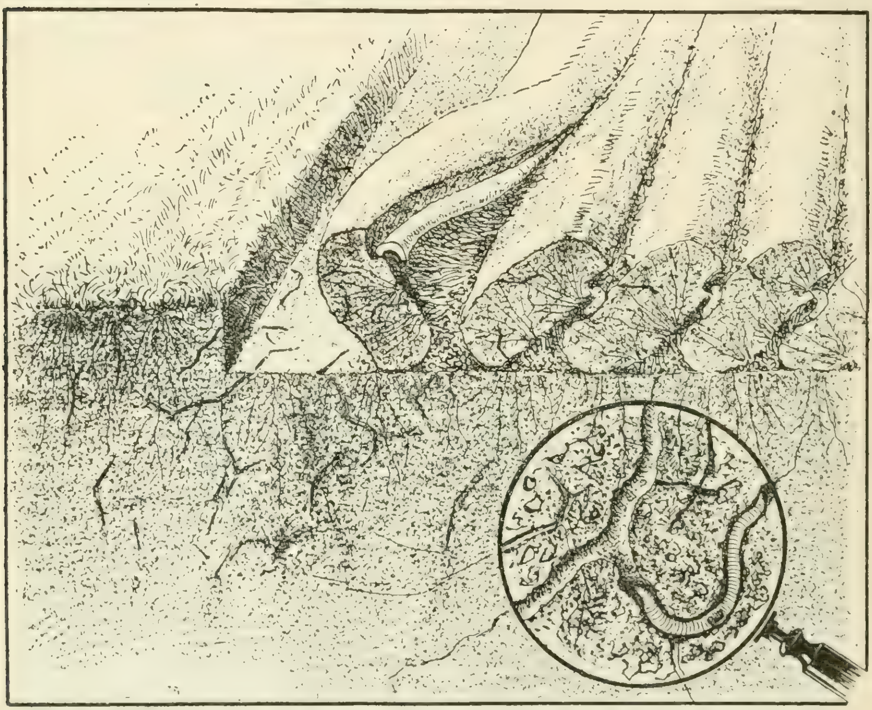

FIG. 87.— *Section of soil showing natural structure and the distribution of grass roots. It shows, also, ideal plowing; the action of the moldboard in twisting the furrow slice; and the action of the jointer in turning under the edge of the furrow. Rather large spaces occur between the furrow slices adjacent to the subsoil. At the lower right hand side is an enlarged view of a section of the subsoil showing distribution of cracks, root cavities, and burrows of worms*

TILTH

The factor that most often determines the adjustment of all these conditions of the soil is physical structure. Soil is a frame-work of particles of rock and organic matter through which many small spaces or pores are distributed. By their size, volume, and distribution, the spaces regulate the other properties of the soil. If the particles are small, the open spaces

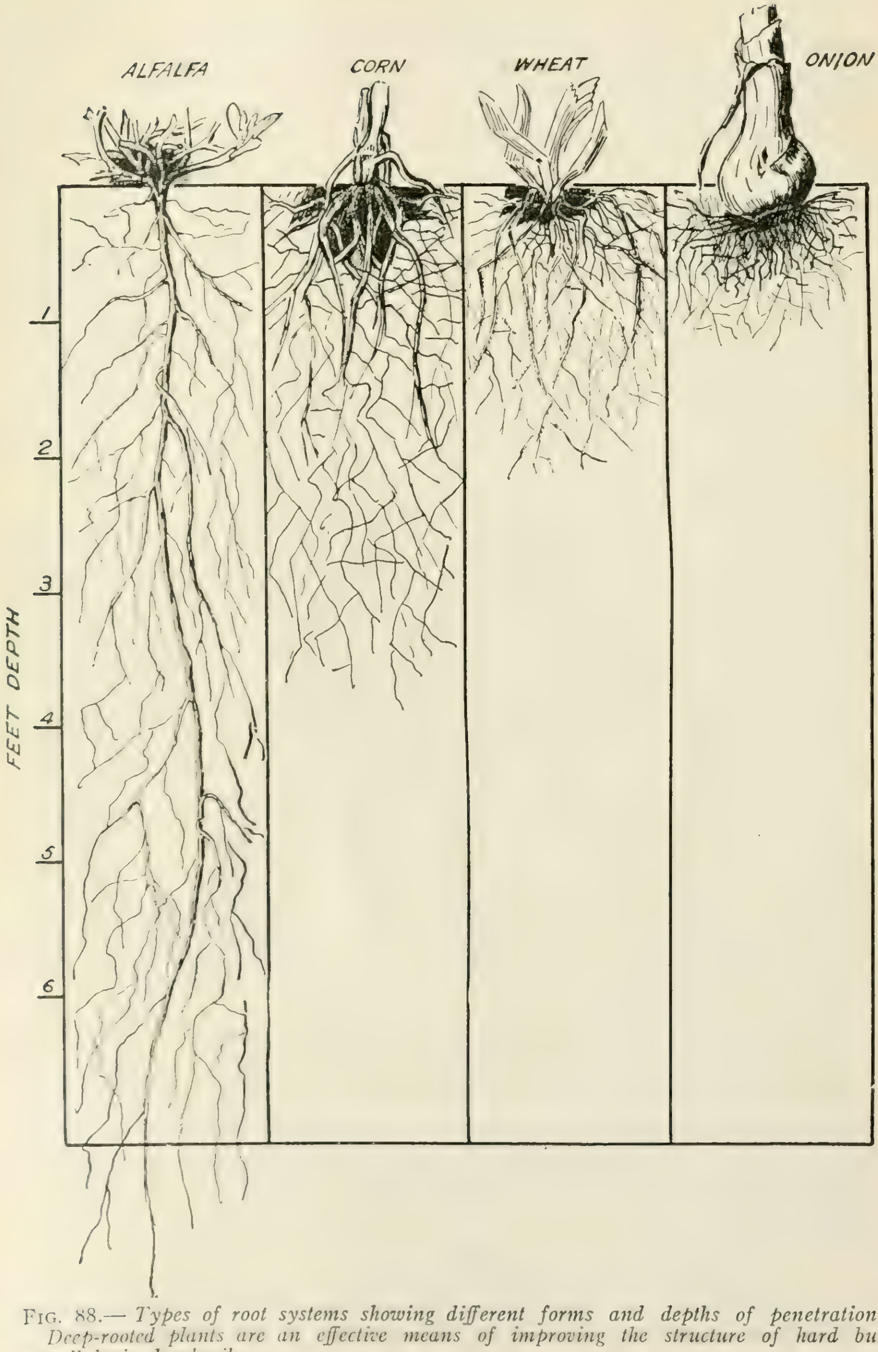

FIG. 88.— *Types of root systems showing different forms and depths of penetration. Deep-rooted plants are an effective means of improving the structure of hard but well-drained subsoils*

are correspondingly small. Spaces that are too small are likely to be continually full of water, which crowds out air and creates bad ventilation. Poor ventilation, in turn, smothers or prevents the development of roots and bacteria. This interferes with the food supply and is injurious in many other ways. If the spaces at the surface of the soil are too small the water that comes as rain does not find ready admission and is lost, so that the crop may later suffer from lack of water which should have been absorbed. Further, soil spaces that are too small, if clogged with water and consequently poorly ventilated, promote chemical and biological processes which are decidedly harmful. Thus, nitrogen in the form of nitrate fertilizer may be broken down to the condition of a free gas, so that it cannot be used by many kinds of plants. Excessive absorption of water due to very small spaces renders the soil cold, and from this arises a chain of injurious results. This brief explanation shows how important is that physical condition of the soil which gives the right size and proportion of pore spaces.

The physical nature of the soil is referred to as *tilth*. The most advantageous character and arrangement of the soil is termed *good tilth*, while the reverse condition is termed *bad tilth*. The maintenance of good tilth should be the first object of the farmer. Consequently he should understand that physical basis on which good tilth rests and the practical means by which it is regulated. This lesson is devoted to a brief explanation of the physical basis, of the things that most directly affect it, and of the action of the more common implements of tillage in their relation to these properties.

As has been indicated, good tilth is identified with the right size of pore space throughout the soil mass. These pores depend for their size on the size and arrangement of the particles of soil. The particles of soil are of many sizes. The term used to refer to the size or fineness of the individual particles of soil is *texture*. A fine-textured soil is one made up mostly of very small particles. A gravelly or a sandy texture is one made up of large particles.

The arrangement of the separate particles in a soil is termed *structure*. Soils may have a loose or a compact structure. Clay in a fine, friable condition easy to stir may be said to have a loose structure. If the separate particles are gathered in groups or kernels such a structure is termed *granular*. But the same soil when mixed and stirred in a wet condition becomes very dense, and such a soil is said to have a compact, or *puddled*, structure.

Texture of soil

Not only are soils made up of particles of different size, but each soil contains particles of many different sizes. These different sizes have

been classified into groups and each division has been given a name. The divisions most frequently used are as follows:

TABLE 1. TEXTURAL DIVISIONS OF SOIL MATERIAL

Name	Size in millimeters	Size in inches
Stone	Above 50	Above 2
Coarse gravel	50 to 10	2 to 1/4
Medium gravel	10 to 2	1/4 to 1/12
Fine gravel	2 to 1	1/12 to 1/25
Coarse sand	1 to .5	1/25 to 1/50
Medium sand	.5 to .25	1/50 to 1/100
Fine sand	.25 to .10	1/100 to 1/250
Very fine sand	.10 to .05	1/250 to 1/500
Silt	.05 to .005	1/500 to 1/5,000
Clay	Below .005	Below 1/5,000

It will be noted that there are more divisions of the small particles than of the large ones. The finer the particles are, the greater is their effect on the properties of the soil in proportion to their volume. Sand is gritty and does not stick together, especially when dry. Silt is flour-like, but not gritty, and the particles have little tendency to stick together. Clay is powdery, and when wet usually becomes very sticky. When dry it hardens and bakes. The clodding of soil is evidence of the presence of clay, although it does not necessarily mean pure clay. A loam soil worked when wet may clod badly.

On these textural groups are based many of the descriptive terms in common use. (Fig. 89.) A sand soil is one made up essentially of sand particles with so small an amount of silt and clay that the latter are negligible. A clay soil is one in which clay particles prevail to such an extent that the soil acts like pure clay. A silt soil contains so much material of the size of silt that it acts essentially like pure silt. A loam soil is one made up of such proportions of all grades of material that no one of them is dominant. If soil is loamy but has one constituent predominant, it may be termed accordingly a sandy loam, a silt loam, a clay loam, or perhaps a silty clay loam. Thus, there may be a great variety of combinations of these materials, giving rise to many classes of soil based on their fineness.

Because of the influence of texture on the properties of a soil and consequently on its relation to plants, soils have sometimes been named according to the kind of crops to which they are suited. For example, wheat soils are generally of a clay-loam texture. The best grass soil is usually a heavy clay. Corn does best on a loam or a sandy loam, and early truck crops are grown on light sandy loam soil.

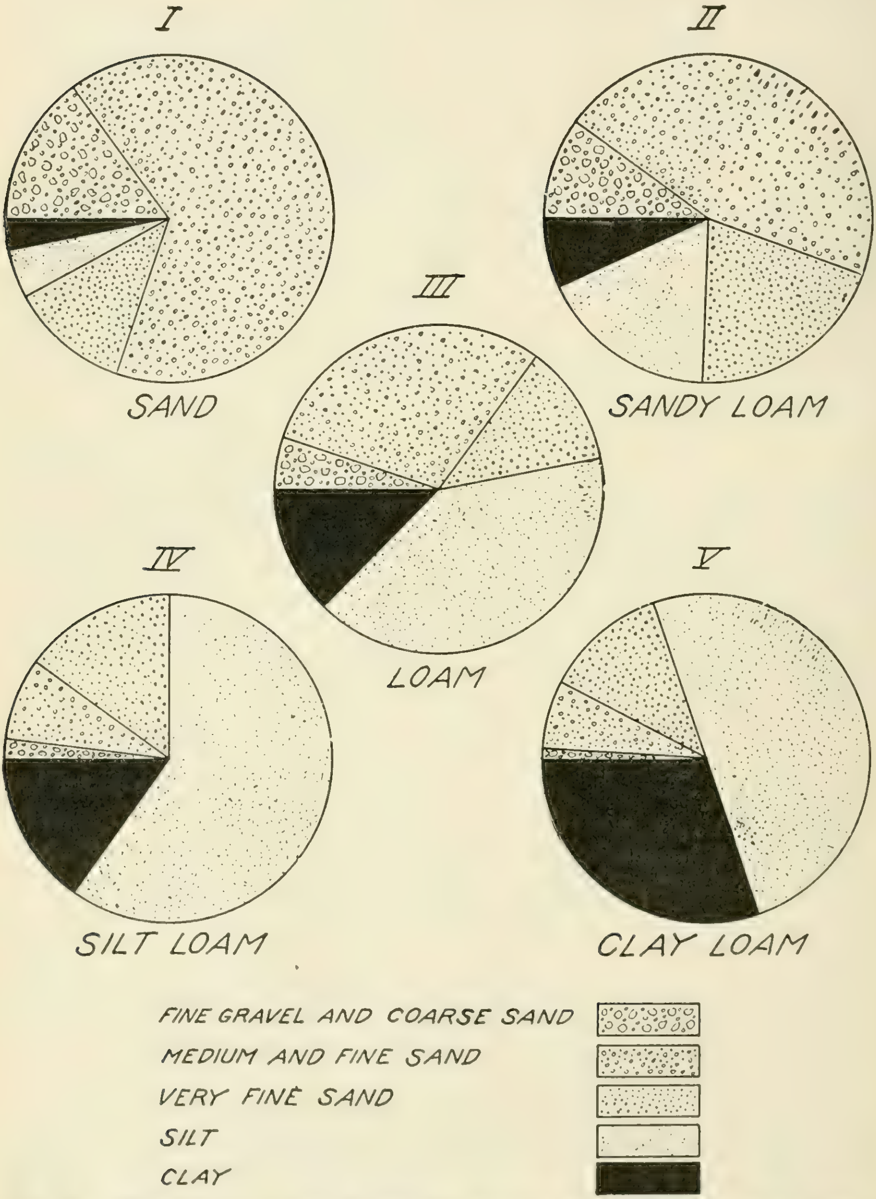

FIG. 89.— *Diagrams representing the textural composition of the more important classes of soil, and the proportion of particles of different sizes that make up each kind*

In a soil of coarse texture the particles of soil are free, one from the other, and rest together as a loose mass. This is well seen in clean sand and in gravel. The size of the pores in the soil is dependent on the size of the particles, and the larger the particles are, the larger the pores will be. For example, the spaces between buckshots are larger than the spaces between bird shots. The total volume of the spaces in a quart of material in either case is approximately the same. If, however, the two kinds of shot are mixed together they will occupy less space than two quarts taken separately, because the small shot partially fill the spaces between the large shot. If, on the other hand, a few of the large and a few of the small shot were fastened together in bunches and these bunches were brought together, they would be found to occupy more space than either of the other arrangements.

Structure of soil

The above illustrates how the arrangement or structure of a soil affects pore space and consequently crop-producing properties. Soils are made up of particles of different sizes, and there are the possibilities of arranging them with granular, open structure or with puddled, compact structure. The finer the soil particles are, the greater possibility there is of changing the nature of the soil by changing the arrangement of the particles. Loam and clay soils are the most difficult to manage because they easily form large, hard lumps or a compact, impervious mass.

A layer of soil that is particularly dense and difficult to penetrate is termed "hardpan." Many things may give rise to this condition. Streaks of clay sometimes produce such a result. In the hill soils of southern New York, large areas of land have a compact subsoil or hardpan composed of shale chips and silt or clay loam closely mixed together. Where the climate is arid, in the western States, the soluble salts sometimes accumulate in layers and cement the soil particles, forming a condition of hardpan.

In soils of a clayey nature the arrangement that is most desirable is a fine, granular structure. This has been termed crumb structure. (Fig. 86.) If the particles are separate and rest together naturally, they form a mass that is too dense for good results. On the other hand, if they are gathered into large chunks, the condition is objectionable because the spaces are too large. Such lumps are called clods. Between these extremes is the happy medium which produces a size and volume of pores that is the most serviceable. It is likely to vary somewhat according to the soil-water conditions, the season, and the kind of crop grown, but these differences can generally be disregarded.

The object in handling all kinds of heavy soil should be to develop a fine, friable, granular tilth which is easy to manipulate and efficient in absorbing and holding water and in permitting the penetration of roots.

Pore space

Much has been said about pore space in the soil. A soil is made up of several materials. Chief of these are the soil particles, water, and air. A fertile soil for the staple upland crops must have a proper proportion of each of these constituents. If there is too much soil there may be a deficiency of water or air or both, according to the division of this space. If there is too little soil the proportion of pore space is excessive. If the spaces are large, as they are likely to be, they permit leaching and retain insufficient water for the needs of plants; and the excessive ventilation

FIG. 90.— *An illustration of soil in bad tilth, and of poor plowing. The soil is heavy clay and was much too wet to be plowed effectively. The shining surface at the bottom of the furrow slice indicates the presence of too much water. Several seasons of careful tillage will be required to overcome the bad effect of such practice*

and the high temperature that result, cause a wasteful decay of organic matter. While heavy clay, on the other hand, may have a larger total volume of pore space, it has the space much more subdivided so that it is effective in absorbing and holding water. When puddled, the pores become so small and the water is held so tenaciously that it is of little service to plants.

The importance of the right proportions of these three constituents and of their relation to texture and structure of soil is well shown in the

diagrams in Fig. 91. In the following table is given the proportion of pore space in some common classes of soil:

TABLE 2. PORE SPACE IN SOIL

Kind of soil	Proportion of pore space	
	Percentage	Parts by volume
Clean beach sand	35 to 40	1/3 to 2/5
Sandy loam. Good tilth	40 to 50	2/5 to 1/2
Sandy loam. Puddled	20 to 40	1/5 to 2/5
Silt. Good tilth	45 to 55	3/7 to 5/9
Clay. Good granular tilth	50 to 65	1/2 to 2/3
Clay. Puddled	25 to 45	1/4 to 2/5

The average size of the pores is much more important than their total volume, although the latter is important. In general it may be remembered that one half of the volume of soil is pore space.

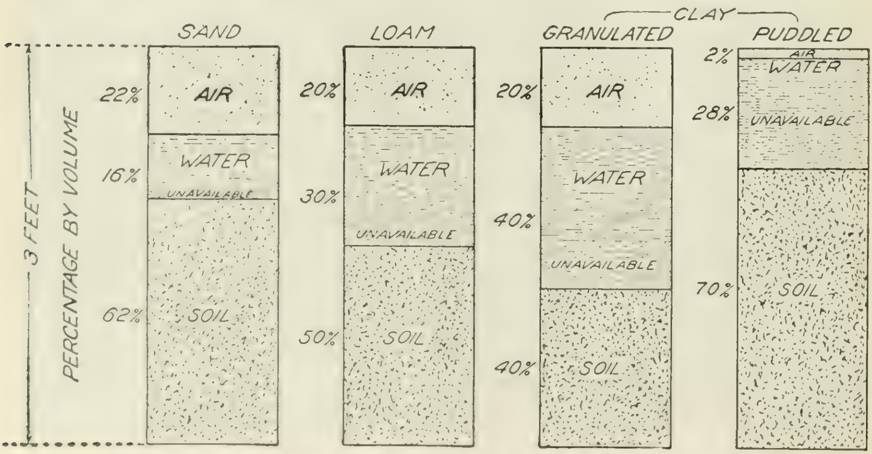

FIG. 91.—*Diagrams representing the proportion of space occupied by soil material, water, and air in a section of different soils. The availability of the soil water and the presence of sufficient air are dependent on the right physical condition of the soil*

The soils of the extremes of texture, as clay, sand, and gravel, and consequently of the extremes in sizes of pores, are adapted to special crops. The soils of intermediate fineness, and therefore of intermediate size of pores, are suited to a wide variety of crops and types of farming. They are used for mixed farming and usually command the highest prices as farm lands. These types include silt, loam, and the different grades of medium and heavy sandy loam. A certain amount of granular structure should be maintained in these latter soils, for they may develop a bad

physical condition. Good tilth, which generally implies a proper state of granulation, is therefore important and attention may well be given to the means for its maintenance.

Methods of improving tilth

Proper tilth of the topsoil may be largely effected by tillage operations conducted at the right time and in the proper manner. With tillage must

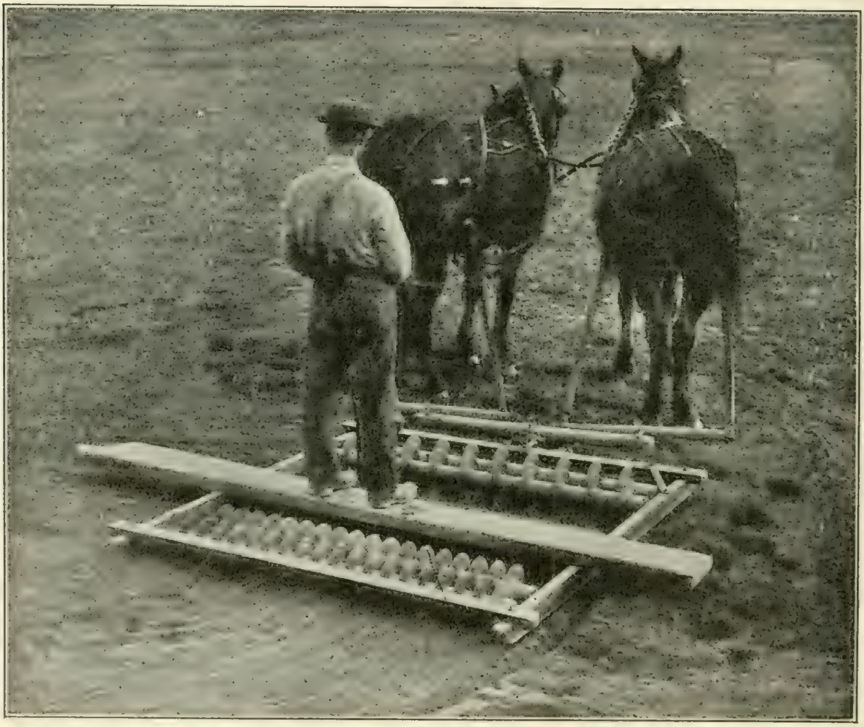

FIG. 92.— *Soil in good tilth. The Meeker harrow is a very efficient pulverizing tool. It consists of a series of small disks fitted rigidly to a straight axle*

be associated the right moisture condition of the soil. The use of crops and crop rotation, of manures, fertilizers, and lime, is helpful to this end.

The full depth of the root-zone cannot usually be reached by surface tillage. Attention should be given to the subsoil quite as much as to the topsoil. A subsoil that is too dense may be improved by various indirect means, particularly by drainage, which promotes beneficial action of plant roots, of earthworms, and of other forms of animal and insect life that live in the soil.

Conditions which promote granulation.— The best conception of the

means of keeping the soil in good tilth may be obtained by a review of the factors influencing granulation:

1. Adequate drainage is the most fundamental of these. It is impossible to keep a poorly drained soil in good tilth. Such a soil is naturally inclined to puddle and compact, and when dry works up into a rough, lumpy condition. Continual wetness breaks down the granular aggregates by dissolving the cementing material, and permits the particles to settle together. The first step toward improvement of soil that is too compact is provision for good drainage by some means, preferably by tile underdrains.

Drainage quickly removes excess water and permits a reasonable amount of drying, which results in cutting and granulating the soil by means of checks and cracks. Without any other treatment, drainage will loosen the soil and provide an improved circulation of water and gases throughout the earth mass. In proof of this is the observation of farmers that underdrains in heavy soil gradually increase in efficiency over a period of years. This mode of action has been described as a " slacking " of the soil, although technically it is a different process. The earth seems to fall apart and loosen to such an extent that certain persons have thought they noticed an elevation of the surface adjacent to the lines of drain. Too much emphasis cannot be placed on the fundamental value of drainage in improving the physical condition of compact soils.

2. Tillage of soil that contains only capillary (film) water is very helpful. If the soil is either too wet or too dry the best results cannot be obtained. (Fig. 90.) That nicely moist condition in which a mass of moist soil pressed in the hand will hold its form but will not show free water, is the right stage for proper tillage. When too dry, a soil breaks into chunks, or clods, that must be broken down.

3. Plenty of decaying organic matter in the form of *humus* is very helpful in developing good tilth. Humus is a dark-colored, gelatinous substance that in many ways helps to produce granular structure. The tendency of soils to settle and bake after years of cultivation is often due to exhaustion of the organic matter. This in turn reacts on the physical and drainage condition of the soil in a way which is doubly injurious. The maintenance of humus in the soil is one of the most effective means of improving the tilth. This applies to sandy land quite as much as to clay land, but in sand the mode of action is different from the process of granulation.

4. Lime has a peculiar effect on clay soils. The fine particles are thrown together in groups or floccules and when the soil dries these become granules. Clay soils rich in lime carbonate have sometimes been mistaken for sandy soils because of this action. Clay soils that have been granulated

work more easily than those that have not. An English farmer is reported to have said that liming clay land enabled him to plow with two horses where three had been required before. This is perhaps an extreme result, but such a general effect of lime is well recognized. Some commercial fertilizers affect soil in the same way.

5. Freezing breaks up heavy soil. As water in the soil freezes it is formed into long, needle-like crystals that cut through the soil in many directions. If a soil is carefully dried from its frozen condition a check will be seen to form wherever a crystal occurred. The network of crystals is so complete and their cleaving action is so tremendous that the hardest clod falls to many pieces after two or three such freezes. (Fig. 93.) The

1 2

FIG. 93.— *These figures represent two pans of clay soil which had been puddled and molded with a smooth surface. While still wet, pan No. 2 was permitted to freeze. Both pans were permitted to dry out. The cracks formed where the structure of the soil was most open. The pattern in No. 2 shows the influence of the ice crystals, and this soil was much more friable and crumbly than the soil that was dried without freezing*

lack of frost action is considered to be responsible for the denser nature of soils in warm countries.

Nothing is more effective in breaking up subsoils than deep fall plowing, by means of which they are exposed to frost action during the winter. In order to obtain its full effect, such fall plowing must be coupled with good drainage. This will prevent the soil from running together during the spring thaws.

6. Penetration of the roots of plants, and the burrowing of earthworms, ants, and other forms of animal life, are important agencies for soil improvement. (Fig. 87.) Tons of material per acre are handled by earthworms and ants in the course of a year. The roots of plants press through the soil,

pry their way into small crevices, and cut the soil in every direction. Crops having fine, fibrous roots, such as buckwheat, are especially noted for their beneficial effect on heavy soil. It is generally recognized that after a clay soil has developed a poor condition by a period of unwise cultivation, good tilth can best be obtained by laying down to grass for a period of years, after which the earth turns up friable and mealy. (Fig. 88.)

The roots of plants, the earthworm, and other soil life, operate only in moist and well-ventilated soil, as has already been noted. If we would have their cooperation, the land must be well drained. The mat of vegetation on the surface formed by plants, especially grasses, protects the soil from the beating and puddling action of rain, from melting snow, and from washing. Plants used for this purpose are known as cover-crops.

TILLAGE

Principles of tillage

Tillage is the manipulation of the soil by means of implements. It may have many objects. The soil may be plowed in order to turn under stubble, manure, and rubbish. It may be cultivated deeply and thrown into ridges for the purpose of drainage. It may be stirred shallow in order to dry out the soil and to create a mulch. One cardinal object of tillage is to stir the soil and expose it to air and light for their sanitary effect.

Lumpy soils need to be pulverized, sandy soils to be packed. Sometimes, in planting small seeds, soil is compacted in order to increase its capillary capacity and to draw moisture to the surface from the subsoil as an aid to germination. Whatever the ultimate result of the tillage operation, all operations affect the soil in one of two ways: either they loosen the soil and render it more open and friable, or they pulverize and compact it and make the structure denser. Choice of the proper tool must be guided by the purpose for which it is to be used. If the soil is to be turned over and the rubbish covered, a moldboard plow should be chosen. If the operation is to reach deep into the soil a larger tool will be required. In order to stir the subsoil a subsoil plow may be necessary. In order to create a mulch on a sandy loam soil we may select the weeder — a light tool which very thoroughly stirs the soil to the depth of an inch. On lumpy or stony soil a spring-tooth harrow or a large-toothed cultivator may be necessary. In order to compact the soil some form of roller may be used. The kind of change to be effected in the soil should first be determined, then the tool may be chosen which will best accomplish the purpose.

All soil-working implements may be divided into four groups: (1) plows that invert the soil in addition to effecting pulverization; (2) cultivators that stir the soil; (3) pulverizers designed to reduce lumps and level the surface; (4) compactors that bring the soil particles closer together and smooth the surface.

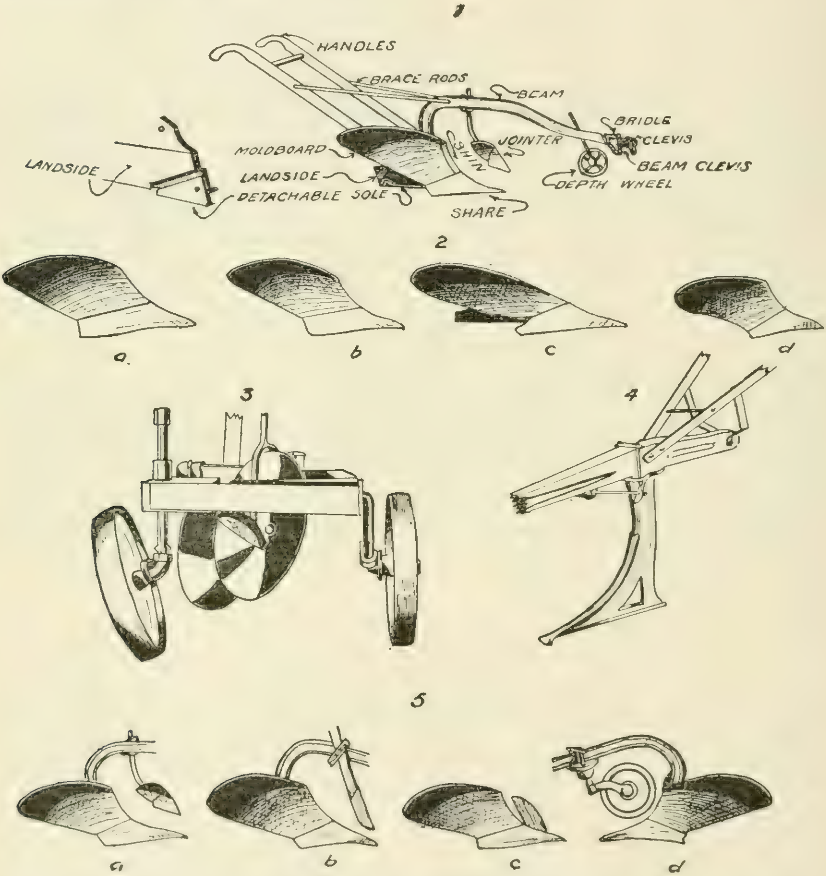

FIG. 94.— *The plow.* (*1*) *Modern walking plow, with parts named;* (*2*) *types of moldboard for* (*a*) *fallow ground, light soil,* (*b*) *fallow ground, clay soil,* (*c*) *sod ground,* (*d*) *general purpose, fairly well suited to a wide range of soil conditions;* (*3*) *deep-tilling disk plow;* (*4*) *subsoiler;* (*5*) *plow attachments:* (*a*) *jointer,* (*b*) *knife or beam colter,* (*c*) *fin colter,* (*d*) *rolling colter*

The plow

The plow is the most efficient implement used on the soil in proportion to the power required. It operates as a double, twisted wedge, which lifts and inverts a ribbon of soil. (Fig 87.) By this operation the furrow slice is sheared or split into many thin layers both vertically and horizon-

tally; the result of this process, when properly done, is a complete pulverization of the soil. Of course the soil must be in the right moisture condition for the best result, as has already been noted (page 1761).

Types of moldboard.— The efficiency of the plow depends much on its type and on the manner in which it is used. (Fig. 94.) As a wedge it may have different slopes, or curvatures. For sod land a long, sloping moldboard with a good overhanging is desirable, so that the furrow will be gradually lifted and turned to its new position in one continuous thread. Breaks and ragged edges of the furrow permit it to be torn up by subsequent preparation. On the other hand, for fallow land (bare soil) a moldboard with much greater curvature is used. This accomplishes more thorough pulverization than would the sod plow. Its draft is correspondingly greater. Special types of plow are designed for work on particular kinds of soil. On both sod and fallow land, a moldboard of intermediate curvature is employed. The hillside plow has a peculiar shape of moldboard, hinged so that it can be turned to permit continuous plowing on one side of the land, thus avoiding so much uphill pulling by working across the slope. There is also a considerable variety in the construction of these implements, and different materials are used in the soil-friction parts. For example, on gumbo clay a moldboard of special composition is required. Various modes of construction are designed for supposed mechanical superiority and convenience.

Right position of furrow.— In order to accomplish good plowing, the furrow should be turned to the proper angle and should be reasonably straight. This requires a particular proportion or relation between the depth and the width of the furrow. (Fig. 95.) The best angle with the surface of the subsoil at which to lay the furrow is thirty to forty-five degrees. In order to obtain this angle it is necessary that the depth of plowing be about one half the width of the furrow. When the plowing is too shallow (one third or less of the width) the furrow slice is inverted. Stubble and rubbish are thereby thrown in the bottom of the furrow, where they tend to break contact with the subsoil and are poorly mixed with the soil. On the other hand, when the furrow slice is set well on edge there is fair chance for capillary rise of water, rainfall readily sinks into the soil along the face of the furrow, and sod and rubbish are more thoroughly distributed from the top to the bottom of the cultivated soil. There is also better ventilation where decay should be most active. At the same time the upper angle of the inverted furrow slice may be easily pulverized and worked into a good seed bed. When the soil bears a heavy sod so that the furrow slice holds its form, heavy rolling and packing are desirable so as to bring it in closer contact with the subsoil and to avoid intersoil spaces that are too large.

Depth of plowing.— Most farmers in New York State should consider deeper plowing. Probably the average depth is not over five inches. Much plowing is even more shallow than this. Particularly is deep plowing better on heavy soils and on those inclined to have a compact subsoil. It crumbles their structure, mixes organic matter more deeply, and as a result of both processes more water is retained and more plant-

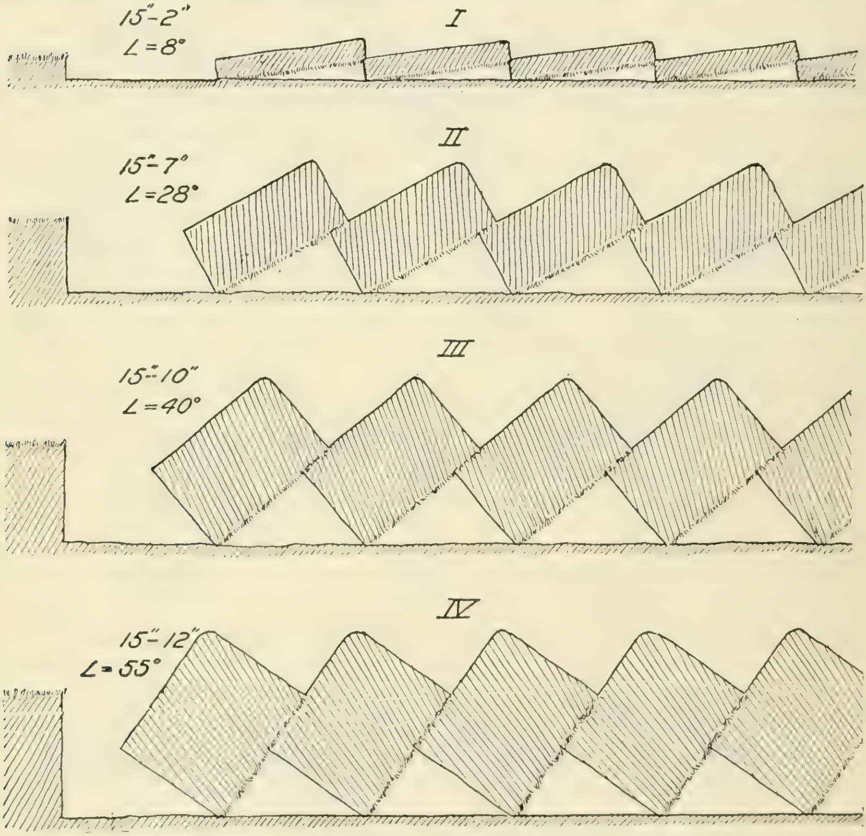

FIG. 95.— *Diagrams illustrating the effect of depth of plowing relative to width of furrow on the final position of the furrow slice. The second and third are the most satisfactory. When set in this position the upper edge of the furrow slices may be readily worked down to a seed bed without the interference of sod which may have been turned under. Manure and turf are well distributed, without breaking connection with the subsoil. Subsequent packing and preparation should break down the lower edge of the furrow slice and bring the topsoil in close contact with the subsoil*

food is available to crops. Deep plowing is an efficient means of increasing the general depth of root penetration; the deeper the roots are distributed, the more uniform is the supply of moisture at their command and the

larger the food supply with which they are in touch. On light sandy soil, deep plowing must be accompanied by the generous use of organic manures.

In the humid section of the country, where rainfall is over twenty inches, the undisturbed subsoil, especially on heavy or poorly drained soils, is likely to be infertile for a time after being brought to the surface, owing to its poor sanitary condition. In that section it is therefore unwise to turn too much fresh soil directly on top in any one season. Usually, it is advisable to increase the depth of plowing gradually at the rate of one half to one inch per year. This is best done in the fall.

The deeper the soil is plowed, the more thoroughly it is pulverized.

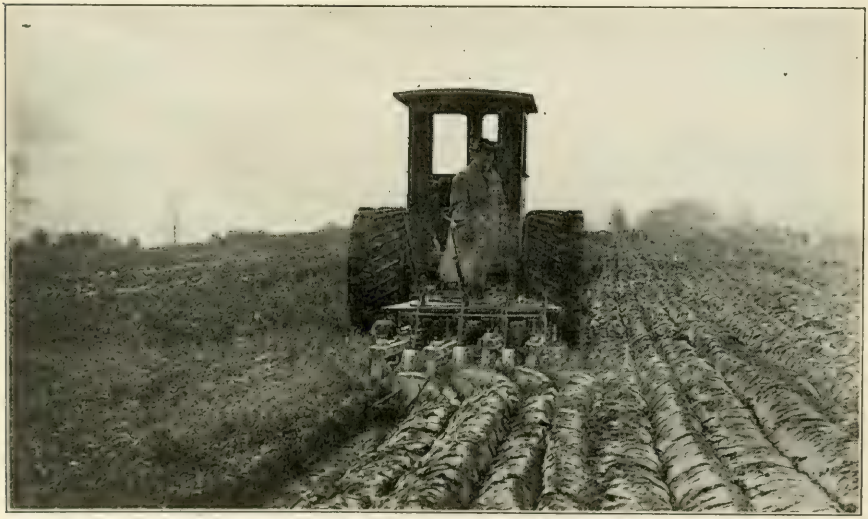

FIG. 96.—*An example of good plowing. The soil is a sandy loam. As good plowing may be accomplished by the use of a team and a walking plow as with this tractor-drawn gang*

Other things being equal, better results are obtained from the same draft in deep than in shallow plowing.

Draft of plow.— Tests by Professor C. A. O'Cock, of the University of Wisconsin, warrant the following conclusions concerning the operation of the ordinary moldboard plow:

First, the draft per inch cross section of furrow cut increases with the increased width.

Second, the draft per inch cross section of furrow cut decreases as the depth is increased.

Third, the sharper the curve of the moldboard, the greater is the draft of the plow. Thus, a fallow-ground moldboard pulls harder than the sod type of the same size.

Fourth, when the soil is either too wet or too dry the draft is increased over that for the soil in good plowing condition.

The draft of the plow will ordinarily be five to nine pounds per square inch of cross section for the stubble type and four to eight pounds for the sod type. For a six-by-fourteen-inch furrow the total draft would therefore be four to five hundred pounds in a soil in good condition. Attachments, dull edges, and stones in the soil increase the draft.

Plow attachments.— Several attachments are used on the plow for special conditions of the soil. (Fig. 94.) On sod land the jointer much improves the result. This is a miniature plow which cuts the surface roots and turns under the edge of the furrow, giving a smoother appearance. It tends also to prevent grass from growing along the soil line of each furrow.

Several types of colter are used on sod or rooty ground for cutting the furrow from the landside. All these should be placed a little back of the

FIG. 97.— *A heavy chain attached to the whiffle-tree and the beam of the plow, as shown in the illustration, is very useful for turning under a heavy growth of vegetation on the soil— as, for example, a green manure crop*

plow point and slightly outside the line of the landside, so as to cut a clear course at the moment when the roots are drawn taut over the point. The rolling and blade colters are attached to the beam. The rolling colter adds less to the draft, and is more satisfactory than the blade colter where there is much surface rubbish. Occasionally, a small fin colter is attached to the share. When the shin of the plow is sharp, especially on fallow ground in good condition, colters are of little service, and the jointer in particular is objectionable owing to the increase in draft.

Moldboard versus disk plows.— There are two types of turning plow, the moldboard and the disk. The former is in most general use and is adapted to the widest range of soil conditions. The disk plow is especially suited to hard, dry soil and does particularly well where there is much rubbish or vegetation to be turned under. It is not adapted to sod land or to soil that is very stony. On stony land the cut-out disk is preferred

to the solid disk. On hard soil the disk plow is more efficient than the moldboard plow for the draft consumed.

Subsoiling.— Subsoiling is the operation of breaking up the subsoil without turning it to the surface. A special plow is used in the bottom of the furrow behind the turning plow. (Fig. 94.) Subsoiling is practiced most safely in the fall. Unsatisfactory results are likely to follow subsoiling in the spring.

Deep tilling implements.— An intermediate implement between the turning plow and the subsoil plow is the Spalding Deep Tilling machine. (Fig. 94.) This is of the solid disk type. There are two disks, one behind and below the other. They are carried on a sulky frame, and by proper adjustment the soil can be worked twelve to sixteen inches deep. Its use appears to be relatively more safe than would be plowing with the moldboard plow to the same depth, for, although the subsoil is stirred, it is only partly thrown to the surface and mixed with the topsoil. In order to accomplish the mixing of the right proportions of subsoil with the soil, special attention must be given to the relative amount of cutting done by the two disks.

Double sulky plow.— The use of the double sulky plow is increasing rapidly. This implement carries two plows, one a right-hand and the other a left-hand pattern, so that all the cutting is done from one side. Dead furrows and back furrows, both of which render the crop uneven, are thus eliminated. Sulky plows, owing to their weight, are not suited to uneven land where it is necessary to pull up the slope.

Cultivation

After plowing, the soil should usually be worked down and pulverized at once. At that time the lumps are most easily pulverized, and by leveling and fining the surface moisture is saved. In the case of fall plowing this practice is not recommended, as the rough surface holds the snow during the winter and is less subject to puddling during the spring thaws. Cultivators stir the soil. For rapid work some type of harrow is generally used.

Harrow.— The harrow is a broad, many-toothed implement, generally without wheels or guiding handles. There are three main types of harrows: the spike-tooth, the spring-tooth, and the disk. (Fig. 98.) The spike-tooth harrow is light, and is therefore suited to rather clean soil in fairly good condition. The spring-tooth harrow draws to the ground better than does the spike-tooth harrow. It works to greater depth and tends to bring lumps and stones to the surface and to collect roots and vines. Usually the slant of the teeth of spike- and spring-tooth implements can be readily adjusted, and this determines the extent to which they stir the soil. The weeder

is a light type of the spring-tooth harrow, suited only to light, loose soils where shallow tillage is desired. The disk harrow, like the disk plow, is more effective for its draft than are other types of harrow. Especially is this true of the cut-out and spading disks, which take hold of hard and stony soil better than do the solid disks. The angle of operation of the disk can be adjusted, and this determines the extent to which it draws to the soil and the extent of pulverizing and turning. Its action resembles that of the plow in that it tends to invert the soil.

The Acme harrow may be regarded as a fourth type. It consists of

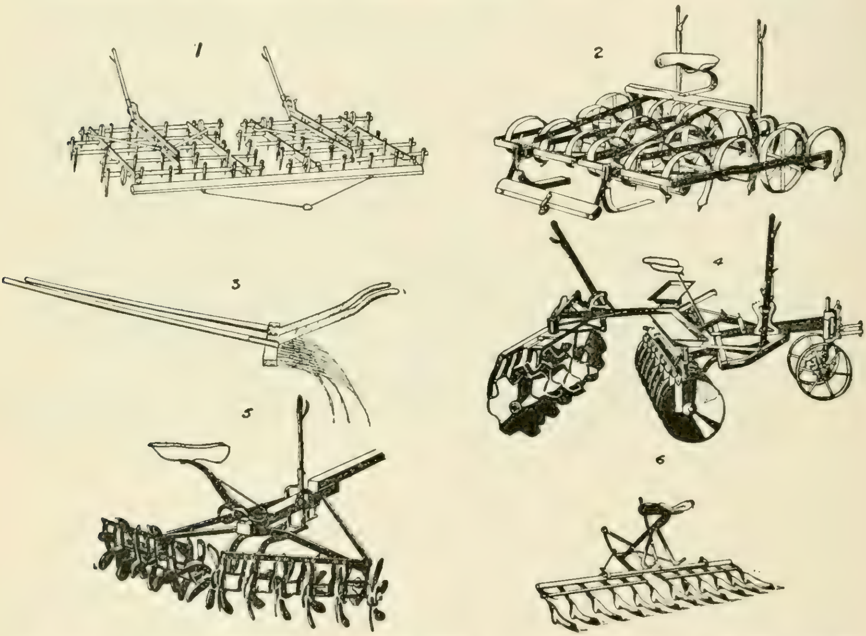

FIG. 98.— *Types of harrows: (1) spike-tooth; (2) spring-tooth; (3) weeder (spring-tooth constructor); (4) double disk (note that the forward disks are solid while the rear disks are of the cut-out type); (5) spading disk; (6) Acme. All these belong to the cultivator group of implements*

long, twisted blades. It is a very useful tool on soil free from stone, but its draft is relatively large.

Cultivators, proper.— The farmer usually makes a distinction between harrows and cultivators. The former are used in order to prepare the seed bed, the latter in order to cultivate or intertill the crop and to kill weeds. The two types are, of course, interchangeable according to crop and convenience. Cultivators that have handles or other guiding arrangement are more easily controlled by the operator. (Fig. 99.) There are many patterns of these on the market, and in their fundamental con-

struction and operation they are much like harrows. They may carry small spike teeth, shovels of different size and shape, spring teeth, or disks; they may be swung on wheels with riding attachment, and in the larger two-wheeled cultivators two or more gangs are carried and guided by the feet of the operator so that one or more rows are worked on both sides at the same time.

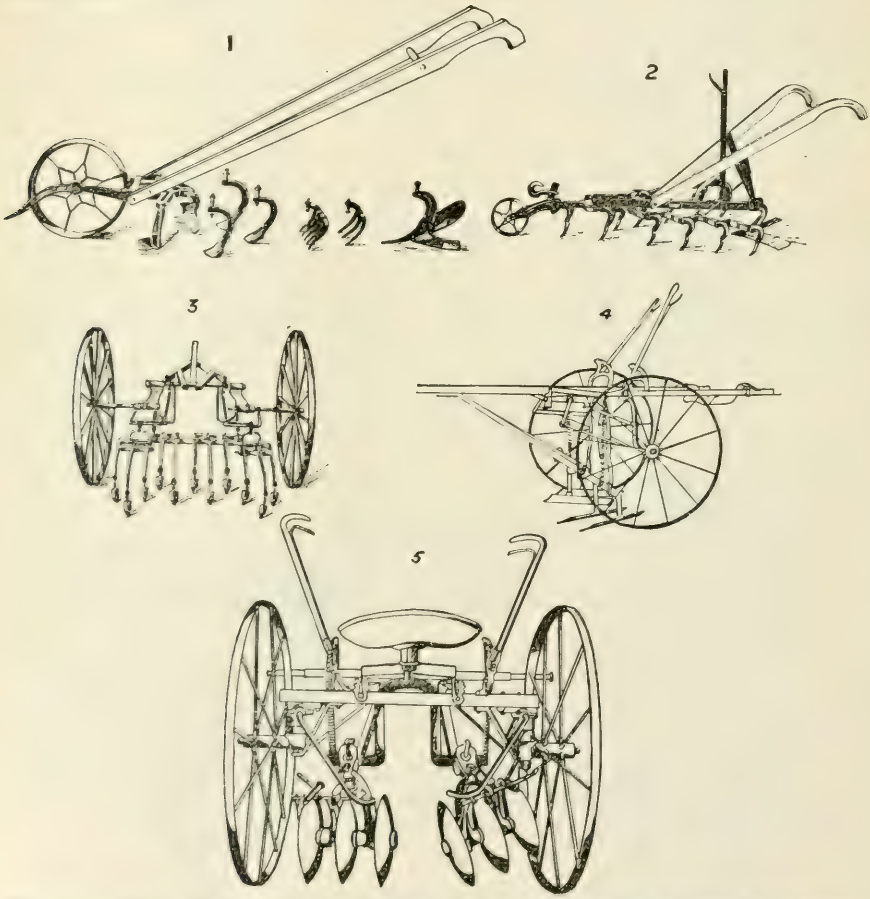

FIG. 99.— *Types of cultivators: (1) wheel hoe, or hand garden cultivator, with attachments; (2) adjustable small-tooth, one-horse cultivator, with duckfoot shovel behind; (3) two-horse spring-toothed cultivator; (4) two-horse sweep or knife cultivator; (5) two-horse disk cultivator*

The general practice now is to use cultivators carrying many small shovels, so that the soil is kept level and thoroughly stirred to a shallow depth. This type is more effective in killing small weeds, in creating a mulch, and in saving water than is the large-toothed type of implement, such as the old-fashioned single or double shovel plow.

A type of shovel cultivator especially suited to cutting off weeds and leaving an efficient thin surface mulch is the duckfoot, wing, or sweep shovel. On stony or hard soil this shovel cannot be recommended.

Pulverizers

Something more vigorous than a harrow is sometimes required on lumpy soil; grinding and crushing action is most effective. For pulverizing and leveling the surface, the plank drag is effective. Clod crushers are a type of corrugated roller, the weight of which may be concentrated on any resistant lump.

Packers

The most common tool used to pack the soil is the roller, of which the log roller is the pioneer type. The value of the roller depends largely on its weight and diameter. For the same weight the smaller diameter is more efficient than the larger diameter. The roller is often used immediately after plowing to press down the furrow slices so that they will not be torn up by the harrow and so that a more level surface is provided for the team. In countries where the winters are severe and the roots of plants are torn loose from the ground by frost, the roller is used in order to press roots into the soil and to firm the soil around the roots so that they may renew their growth. Rollers usually are made in two or more sections for convenience in turning, and have a basket or some other arrangement for loading in order to increase the weight. As a pulverizer the solid roller is inefficient. (Fig. 100.) Its weight is distributed over too much surface and it is likely to press the clods into the soft soil rather than to crush them.

Another type of roller is the subsurface packer, which comes near to being an ordinary clod-crusher. Its surface is broken so that it cuts into the soil and exerts pressure to considerable depth. It is especially useful in the spring of the year and in arid regions, in pressing the furrow slice into close contact with the subsoil and at the same time leaving a loose layer of soil on the surface as a mulch to save water.

Special soil-working tools

There are a number of instruments designed for use in special crops or under special conditions. Among these may be mentioned: (a) the lister, which plows and plants at the same time, used mostly under semi-arid and pioneer conditions; (b) the grape and berry hoe for working close to small fruits; (c) the adjustable disk for reaching under trees with low-hanging limbs. It should be said also that many seeding implements cultivate and pulverize the soil in the process of planting the seed. The grain drill, in particular, is of this sort.

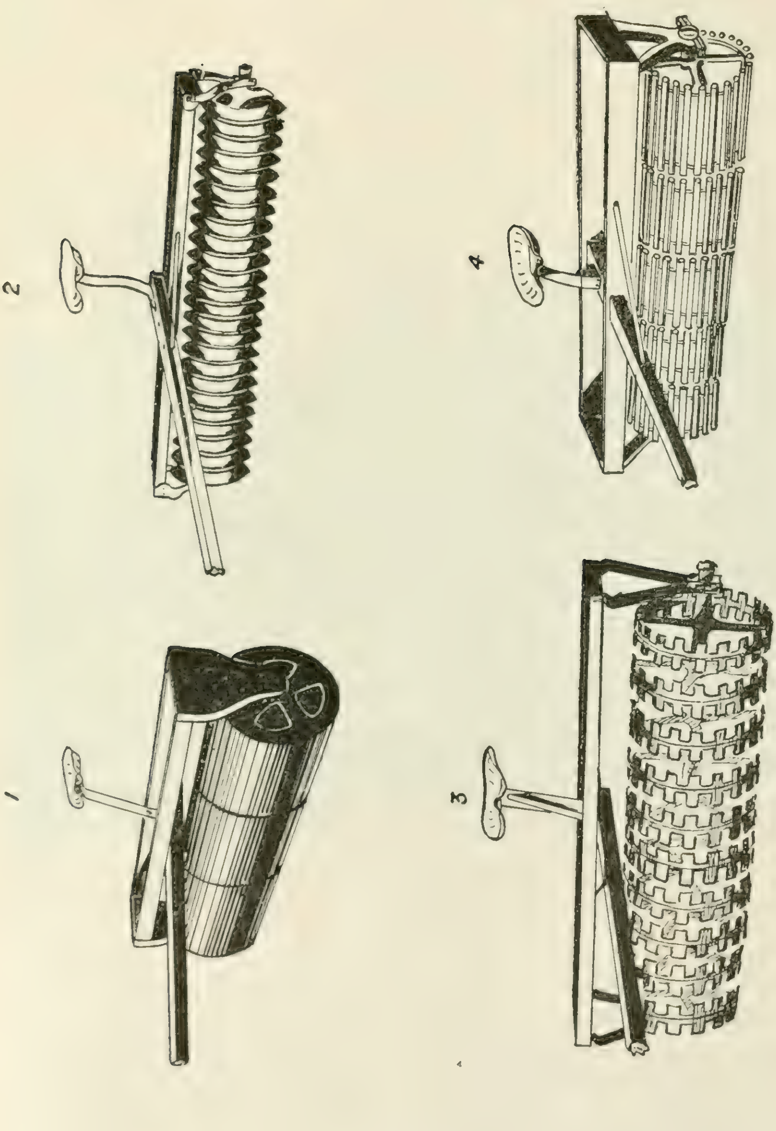

FIG. 100.— *Types of packers and pulverizers: (1) solid or barrel roller; (2) corrugated roller; (3) crusher and subsurface packer; (4) bar roller*

Special soil conditions

There may be many special conditions of soil or subsoil, of season or crop or equipment, which require peculiar treatment, so that always the purpose to be accomplished should determine the use of an implement. If the soil were a little too wet it might be thrown up in high ridges with a large shovel plow in order to hasten the evaporation of water. In an old orchard long in sod, plowing should be shallow in order to avoid injury to the roots of trees. In the late fall a soil may sometimes be safely

FIG. 101.— *The planker. A homemade implement that is very efficient in pulverizing the soil and smoothing the surface. Its pulverizing action in connection with a toothed harrow is often more efficient than the roller*

plowed while in a very wet condition, when winter freezing is depended on to counteract any possible puddling.

In windy regions sandy soil should not be fall-plowed, since it is likely to be blown away. In parts of the Southwest, plowing in large ridges is found to be more successful in saving moisture than the formation of a level surface, because such plowing prevents the wind from carrying away so much soil and thus conserves moisture.

Circumstances will always alter cases. It is impossible to lay down fixed rules in the handling of the soil, even for a particular farm, because

of the many conditions involved. There is required on the part of the farmer an understanding of the principles involved, keen observation, and good judgment, in order to know what combination of treatments will give the best results at the least cost.

An important object of tillage is to kill weeds, because weeds rob the regular crop of moisture, food, sunlight, and air. Weeds are most easily overcome when small, and sometimes rough tearing up of the soil and waste of moisture through exposure is justified in order to cover and to kill the weeds. This is a common means of overcoming small weeds in the row.

Tillage by dynamite

A type of tillage that is now much advertised for soils inclining to a

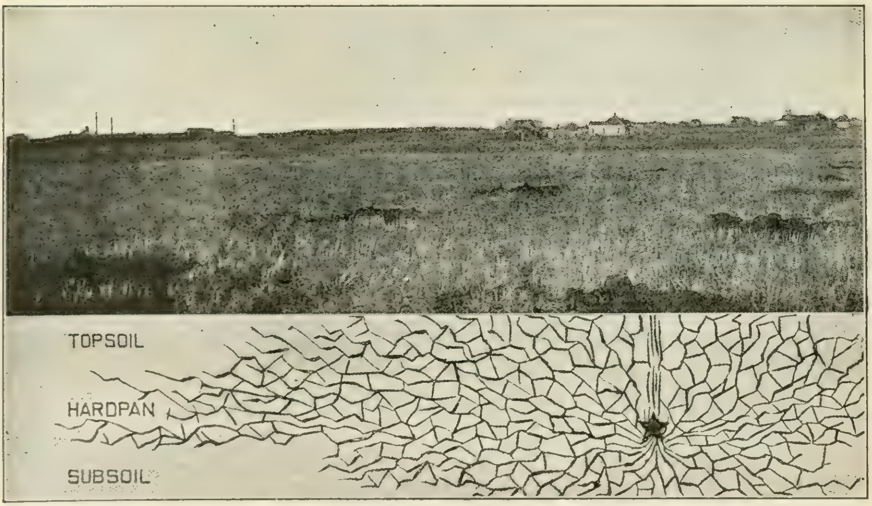

FIG. 102. – *Section of soil illustrating the proper position of a charge of dynamite with reference to a hardpan layer, and its supposed action in breaking up a compact condition. For efficient results the subsoil should be dry.* (*Sketch by DuPont Powder Company*)

hardpan structure is the use of dynamite. The explosion of small charges of dynamite at frequent intervals (ten to twenty feet) in the subsoil, at a depth of two or three feet, is said to loosen the soil much as though a subsoil plow had been used. (Fig. 102.) Whether to use dynamite or a plow is a question of cost and efficiency where such a condition of soil exists. In either case the soil should be relatively dry. Dynamite has the advantage on stony soil and may be more efficient for deep work, but the cost per acre is high as compared with tillage operations and the question arises whether there are many areas of soil in New York State where the

treatment is justified. Unless it breaks through the hardpan soil to some porous layer below, dynamite is likely to make drainage conditions worse rather than better, and on the great majority of New York lands its use for this purpose has no place. Thorough drainage, which costs little more, will in time have much the same effect on the subsoil and it produces more generally desirable and permanent results. The best results on very hard soil are likely to follow the combined use of dynamite and drainage. Dynamite should be used fist.

In conclusion it should be remembered that cultivation and all the operations that aid in maintaining good tilth contribute to the ventilation of the soil and are especially beneficial in their sanitary influence. Stirring and turning and thorough preparation before seeding, together with as much tillage as possible during the growing season, are essential in order to keep every active soil in a healthy, fresh condition. If little cultivation is possible, it is more important before planting. The intelligent farmer knows that the prize crop usually follows the most thorough preparation of the soil. He works the soil over and over even after it seems to be in good tilth. Jethro Tull, the shrewd English farmer of two centuries ago, was wise beyond his day when he said, "Tillage is manure." It is manure and it is health to the soil. Centuries before the time of Tull, Vergil had written the same experience into his verses descriptive of Roman husbandry:

> "Much more advantage to the swain it yields
> To use the rake, than harrow sterile fields:
> Nor golden Ceres, from the lofty skies
> Shall view his labor with regardless eyes.
> And who, athwart the furrows, plows the plain,
> Then breaks the clods obliquely o'er again,
> Turning his team, and by a frequent toil,
> To obedience brings a disobedient soil."

Sometimes better results have followed hand work with fork and hoe than the use of larger implements. This may be attributed to the deeper and more thorough preparation of the soil in hand work, and emphasizes the well-observed fact that thorough tillage is a prime requisite for good crops.

ADVANCED READING

The Reading-Course lessons are designed merely to introduce the subject; they are elementary and brief, and are intended to arouse a desire for fuller knowledge along particular lines. The study of Reading-Course lessons should be introductory to the study of standard agricultural books and of the bulletins of the United States Department of Agriculture and the state experiment stations. · The Supervisor of the Reading-Course will suggest, as far as possible, agricultural literature to meet the needs of any reader. Particular books or bulletins are recommended because they are thought to be of special interest to the reader in his individual study and not because they are considered superior to others on the same subject.

Principles of soil management. T. L. Lyon and E. O. Fippin. Pages 68–119, 465–497. The Macmillan Company, New York City.. $1.75

Fertilizers and crops. L. L. Van Slyke. Pages 89–104. Orange Judd Company, New York City........................ 2.50

Farm machinery and farm motors. J. B. Davidson and L. W. Chase. Pages 51–101. Orange Judd Company, New York City.. 2.00

Physics of agriculture. F. H. King. Pages 108–128, 223–254. Published by the author, Madison, Wisconsin.............. 1.75

Bulletins, United States Bureau of Soils:

No. 50. Moisture content and the physical condition of soils

No. 82. The effect of soluble salts on the physical properties of soils (Distributed by Superintendent of Documents, Washington, D. C., at a nominal price)

Farmer's Bulletins:

No. 421. Control of blowing soils (Free on application to Senators or Representatives in Congress or to the Secretary of Agriculture, Washington, D. C.)

Bulletins, Kansas Agricultural Experiment Station (Manhattan, Kansas):

No. 127. The roots of plants

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	22	The culture of the currant and the gooseberry
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Vegetable-gardening	30	Hotbed construction and management
	34	Home-garden planning
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	38	Principles and methods of plant-breeding
	44	Methods of breeding oats (in press)

The above list is correct to June 15, 1913. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 42 | ITHACA, NEW YORK JUNE 15, 1913 | THE SOIL SERIES No. 2

TILTH AND TILLAGE OF THE SOIL

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. The answering of the questions is optional, but a majority of readers accept this opportunity for additional work. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if information is requested.

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Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, New York, under the Act of Congress of July 16, 1894.

1. In what ways does the soil provide conditions for plant growth?

2. How and to what extent does the physical structure or the tilth of the soil affect its productive power?

3. What is the physical nature of the soil in your region? Is it gravelly or stony? Is it sand, loam, silt, clay, or some combination of these?

4. Are the soils in your region in good tilth? Are they either too compact or too open for the best operation? By what means may they be improved?

5. Is there any "hardpan" in the soil? If so, describe it. In what ways may it be broken up and made favorable for the development of plant roots?

6. Explain the benefits of deep plowing.

7. How deep is the soil plowed in your region? Does this vary with the soil, the crop, or the season? What do you consider the best depth to plow your soil, and why?

8. When is most plowing done in your region, in fall or in spring? Which do you consider best for your soil? Why? What, if any, are the advantages of fall plowing?

9. What do you consider the best method in working soil down to a good seed bed?

10. What kinds of plows are most used in your region? Are you using the type of plow and shape of moldboard which will give best results? Why?

11. What kind of cultivators and harrows are most used in your region? Why do you think they are best?

12. Is the roller used in your region? For what purposes? Are any other pulverizing implements used? Describe them. Which are the most efficient on your soil, and why?

Name..

Address..

Date..

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 44 | ITHACA, NEW YORK JULY 15, 1913 | PLANT-BREEDING SERIES No. 2

METHODS OF BREEDING OATS*

H. H. LOVE

(In cooperation with the Bureau of Plant Industry, United States Department of Agriculture)

Oats constitute one of the most important field crops of New York State.

FIG. 103.— *View of oat-breeding plats of the Department of Plant-breeding at Cornell University*

According to the statistics for different crops in 1911, taken from the Year-

* Paper No. 35, Department of Plant-breeding, Cornell University, Ithaca, New York.

Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, New York, under the Act of Congress of July 16, 1894.

book of the United States Department of Agriculture, the oat crop was third in farm value in New York State. Hay ranked first, with a farm value of $86,958,000; potatoes second, with a value of $24,975,000; and oats third, with a value of $19,709,000. For the year 1911, New York ranked twelfth in total acreage planted with oats, ninth in total yield, and nineteenth in average yield per acre. The average yield per acre was 29.5 bushels. For the years 1900 to 1909, also, New York ranked nineteenth in average yield per acre, which was 31.3 bushels. This yield is

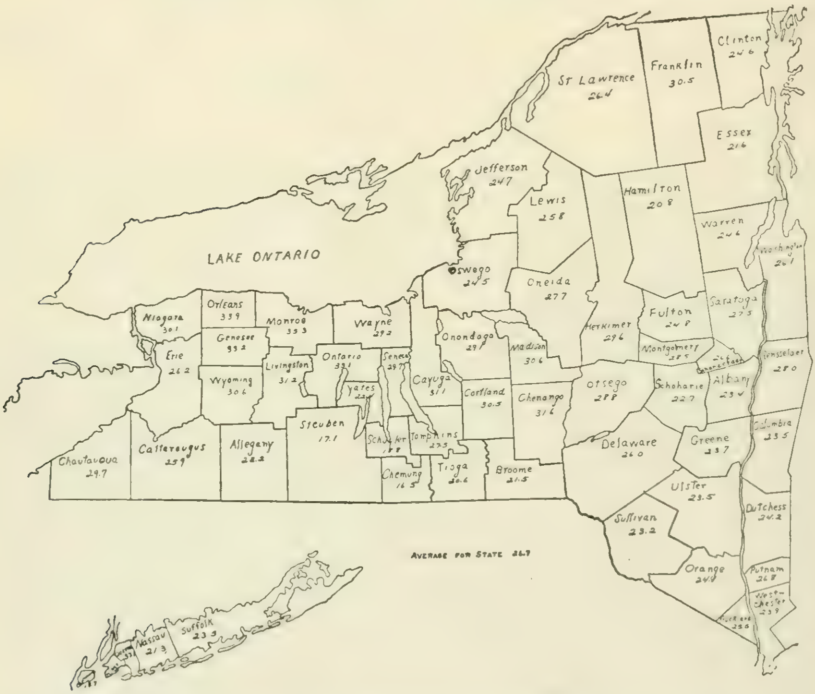

FIG. 104.— *Map of New York State, showing average yields of oats for 1909 in the different counties*

low and effort should be made to increase it. The average yield for each county in the State in 1909 is shown in Fig. 104. These yields were obtained from the report of the Thirteenth Census of the United States.

Oats are valuable to farmers because they fit in well with the many systems of crop rotation used in this State. Oats are also much used as a nurse crop when land is to be seeded to grass; the value of such a crop is doubtful, however, for many nurse crops are robber crops.

Since oats form one of the most valuable field crops of the State it is

important to increase the production by increasing the yield per acre. Better methods of culture and the use of better varieties for seeding purposes will aid materially in increasing production. For the past six years experiments have been conducted by the Department of Plant-breeding at Cornell University, in order to improve the yield of oats. The oat-breeding plats on the experiment station farm, from which the following results have been obtained, are shown in Fig. 103.

There is a great demand for good seed of all crops and this is especially true of oats. Growers are looking for a better grade of seed and are willing to pay for good quality. It is desirable, however, to know whether a certain variety is adapted to the soil and the climate in which it is to be grown. Not all varieties are adapted to the same locality, for, in a given field, some will do well while others will fail completely. It is important, then, for the grower to know local conditions and to try to find a variety that will do well under those conditions. Usually it is not possible for the grower to know whether a variety of seed oats that may be offered for sale is better adapted to one locality than another until it has been tested on his farm.

How, then, is a farmer to obtain a good strain of oats? One of the best ways is to choose the seed and to develop a strain that is well adapted to local conditions. The grower may say that it is too much trouble to choose his own seed. It is not too much trouble if one considers the time and the money lost in planting inferior seed or seed that is not suited to a given locality. It is the purpose of this discussion to point a way for the improvement of oats.

DIFFERENCES BETWEEN VARIETIES

Before any crop-breeding work is undertaken, the first point to be settled is the choice of a variety with which to start. It is necessary to know the locality or environment in which the seed is to be grown, and to study several varieties in order to determine which are best adapted to the locality. The farmer would do well to obtain seed of four or five well-known varieties and to grow small plats of these for at least two or three years before any breeding is undertaken. Varieties may differ in many ways. Some are more resistant to drought than others, some are more susceptible to rust or more affected by smut than others, and some have stiffer straw, thicker hulls, or larger grain than others.

The Department of Plant-breeding has been conducting tests of commercial varieties of oats, as well as experiments in breeding this crop. The results of some of these tests of commercial varieties are shown in Table 1:

TABLE 1. COMPARATIVE YIELDS OF EIGHT COMMERCIAL VARIETIES FOR THE YEARS 1910, 1911, AND 1912, AND THEIR AVERAGE WEIGHTS PER BUSHEL

Variety	Yield per acre (bushels)			Average yield per year (bushels)	Average weight per bushel (pounds)
	1910	1911	1912		
Lincoln	66.0	58.9	70.4	65.1	30.40
Silvermine	58.1	64.8	60.9	61.3	30.17
Danish Island	54.3	53.8	64.8	57.6	29.46
Swedish Select	58.5	45.5	55.9	53.3	29.87
Welcome	54.1	41.5	56.5	50.7	29.40
White Tartar King	53.0	38.0	52.3	47.8	31.62
Black Tartarian	35.6	45.8	52.0	44.5	28.78
Golden Giant Side	37.6	47.1	47.8	44.2	28.31

The results given in the above table show the great differences with respect to yielding power that exist among varieties. Although these varieties were grown under identical conditions, there is a range in average yields from 65.1 bushels for Lincoln to 44.2 bushels for Golden Giant Side. There is also considerable difference in weight per bushel. The weight varies from 31.62 pounds for White Tartar King to 28.31 pounds for Golden Giant Side. The difference in size or weight of kernel and in percentage of meat in the different varieties is very marked. This is shown by the following table:

TABLE 2. WEIGHT OF ONE HUNDRED KERNELS BEFORE AND AFTER HULLING, AND PERCENTAGE OF MEAT IN SEVERAL COMMERCIAL VARIETIES OF OATS

Variety	Weight of 100 seeds	Weight of 100 seeds hulled	Percentage of meat
Lincoln	2.578	1.832	71.06
Welcome	2.573	1.786	69.41
Swedish Select	2.481	1.651	66.54
Long's White Tartar	2.391	1.684	70.43
Storm King	2.820	1.642	58.23
Mortgage Lifter	2.725	1.880	68.98
Twentieth Century	2.576	1.781	69.14

From this table it is apparent that, although kernels may be of nearly the same size, there is a great difference in the amount of meat. For example, although the weight of one hundred seeds of Swedish Select is nearly equal to that of one hundred seeds of Lincoln, the percentage of

meat is 4.52 greater in the latter variety. This means a difference of 4.52 pounds of meat for every one hundred pounds of grain.

The table shows also that large seed does not necessarily represent highest quality. In order to prove this, Storm King and Long's White Tartar may be compared. While the seeds of Storm King are much larger than those of Long's White Tartar, there is only 58.23 per cent of meat in the seed of the former variety as compared with 70.43 per cent in the latter. This means a difference of 12.20 per cent of meat for every one hundred pounds of grain, in favor of Long's White Tartar.

These facts show that the grower should not buy large oats for seed if that is the only qualification which they possess. When two samples of oats are offered for sale, one having large seed and the other small, the grower will often buy the large-seeded variety. If the large-seeded variety is known to be a good yielder and to have a thin hull, it is well enough to buy it; but a variety of oats should not be judged merely by the size of its seed.

There is also a great difference among varieties as to yield of straw and of grain and as to the ratio of grain to straw, or, in other words, the number of pounds of straw required to produce a pound of grain. For the last two years the Lincoln variety has yielded 1.362 ton of straw per acre and 64.6 bushels of grain, while Golden Giant Side has yielded 1.418 ton of straw and 47.4 bushels of grain. The ratio of straw to grain for the Lincoln variety was 1.32, while that for Golden Giant Side was 1.87. It is evident that more straw was required to produce a pound of grain in the case of the Golden Giant variety than in the case of Lincoln. This also indicates that the variety which yields a large amount of straw is not always the most desirable from the standpoint of grain.

METHODS OF IMPROVEMENT

After the variety has been decided on, the next step is to consider what methods are to be used in its improvement. There are two general methods for the improvement of all crops, selection and hybridization. These have been fully described in Lesson No. 38 of the Cornell Reading-Course for the Farm.

Selection

The method of selection is the first to be considered. As is well known from the study of commercial varieties of oats, a variety is composed of many different types. It is possible to go into a field of oats of a commercial variety and select a dozen or more different types. These different types may have occurred suddenly in the variety; or, more probably, they may have been brought about by what is known as mechanical mixing, due to threshing one variety immediately after another with the same

machine. As a threshing machine is moved from farm to farm it carries some grain from one place to another, and when the next variety is threshed the seed becomes mixed. In some localities it is a common practice to save the first load of oats for seed. This always means that the second man, in his load of seed oats, gets practically all the seed carried by the threshing machine from his neighbor's farm. If the practice of saving the last load were followed, little mixing would occur from threshing outfits.

Mixing may occur also through careless handling, as a result of which varieties are kept so close together in a seedhouse that seeds of one variety may fall into a bin containing seeds of another variety.

What to select.—When a grower selects oats or any other plants for seed, the question immediately arises as to what character should be selected and what kind of plants should be saved. When one observes a field of oats he immediately notices that certain types are producing larger and better plants than others and are therefore much better yielders for that locality. If these vigorous, high-yielding plants were saved separately and grown, a pure strain of the desired type would soon be obtained. Care must be taken to select heads in which the kernels are numerous and well filled. Heads with only one kernel in the spikelet should not be selected for seed. Notes should be taken regarding the thickness of the hull and the plumpness of the seed. This can be done better after the heads have been selected in the field and taken to the house for further study.

Heads that show a tendency to shatter and those from which some of the kernels have been lost should not be saved. Care should be exercised to select heads from plants that have stiff straw and that stand well in the field.

When there are panicled, or branched, heads, and side, or mane, oats (Fig. 105) in the same field, both may be selected. As a rule, side oats show a greater tendency to lodge during a heavy wind or a rainstorm than do panicled oats, since all the weight is on one side and this may cause the head to break over when very wet.

In making selections from the field the grower should be careful to make them where the seeding has been done uniformly and where some of the plants have not had undue advantage over their neighbors. If the grower selects plants that are large merely because they have been grown in a more favorable part of the field, where there has been better nutrition, more moisture, or thin seeding, it will not necessarily follow that these plants will yield better than their neighbors when grown under the same conditions. It is usually better to select from the most thickly seeded part of the field, where the fertility is average for the field.

Mass selection.— Selection may be divided into two classes, mass selection and individual selection. In practicing mass selection the grower selects large heads from vigorous plants of the most desirable type in his field and mixes the seed from these heads for sowing in the following year. In the following year he again goes through his plat and makes selections, keeping the desired type in mind. The seed from the second selection is mixed and another plat is sown. This process is repeated for several years.

FIG. 105.— *Showing the two types of oats. Panicled, or branched, head on the right; side, or mane, head on the left. This also illustrates what is meant by the term spikelet (sp)*

By this method the grower obtains a strain of oats more nearly of one type, and, if the work is done carefully, a better-yielding strain than the commercial variety from which the selections were made. The commercial variety will yield less, because it is composed of not only the good-yielding sorts that have been isolated through selection but also the many poor-yielding sorts which tend to lower the yield of the variety.

This point is well illustrated by the yields of two selections from the Sixty Day variety, which for the past six years have produced 57 bushels and 51.9 bushels, respectively — a difference of over five bushels between

two strains that have come from individual plants selected from the same commercial variety.

Individual selection.— Individual selection is more tedious and more difficult to follow than mass selection; it is to be recommended rather than mass selection, however, although the latter method is better than none. When practicing individual selection the grower chooses good heads on vigorous plants in his field, just as is done in mass selection.

At least one hundred heads should be selected and each head given a number. The simplest method of numbering is to designate the first head No. 1, the second No. 2, and so on. As soon as the heads are thoroughly dried they should be carefully threshed, the seed from each head being kept separate and preserved in manila envelopes out of reach of mice.

FIG. 106.— *Planting head rows on the plant-breeding plats of the Cornell University Agricultural Experiment Station*

At planting time thirty seeds, as nearly uniform as possible, should be chosen from each head. These seeds should be planted in rows one foot apart and two inches apart in the rows. The rows must be five feet long in order to accommodate this number of seeds. Each row should bear the same number as the head from which the seed was taken. The plan that is followed in the planting of small grains on the experiment station farm is shown in Fig. 106.

In order to determine whether the selected heads are any better than the variety from which they were obtained, it is well to take a mixed lot of seed from the variety that grew on the field from which the heads were selected, and to sow every sixth five-foot row with thirty seeds from this mixed sample, which represents the variety. A plan for sowing these rows, which will here be called "head rows," is shown in Fig. 107.

During the growing season the rows should be visited occasionally and any differences between them noted. For example, if one row shows a

tendency to lodge more than another, the number of this row should be carefully recorded. If some of the rows are more affected by rust or smut than others, these also should be carefully noted. Exceptionally good rows should be marked so that all the seed from them may be saved. At harvest time each row that has shown promise should be harvested separately, tagged with the row number, and allowed to dry for threshing.

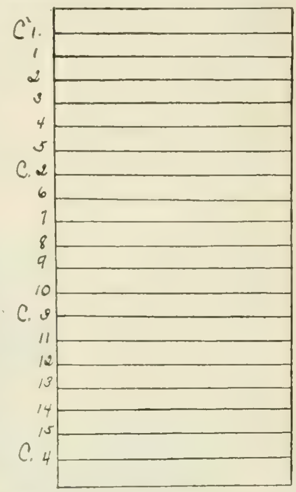

FIG. 107.—*Plan for planting head rows of oats*

If this work is to be followed carefully it is well to cut practically every row. However, it is not necessary to harvest those rows that are badly affected by disease or that show a great tendency to lodge. The check rows should be harvested, and their position in the plat should be noted so that the yields of the selected head rows near by may be compared with the check yields.

When a strain that will produce good yields of both grain and straw is desired, it is well to weigh the product of the rows before it is threshed. This weighing can

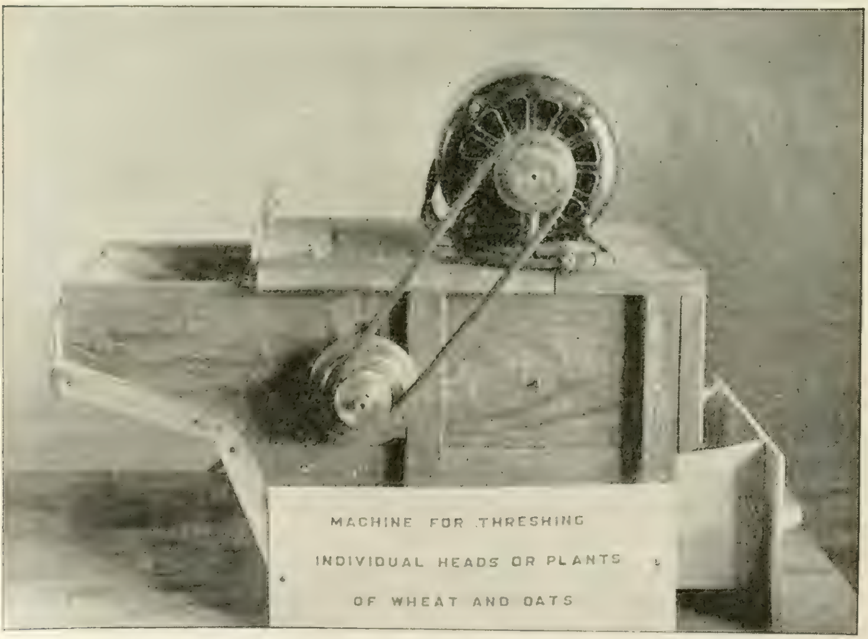

FIG. 108.—*Machine designed by H. W. Teeter of the Department of Plant-breeding at Cornell University*

be done on a family spring scale or on a large postal scale. The grain should then be threshed either by flailing it or by rubbing it carefully between two large blocks of wood covered with corrugated rubber such as is used for step covering.

If this work is to be done very carefully it will be found convenient to build a small machine for threshing, such as is shown in Fig. 108. This machine consists merely of a cylinder and concave, the teeth of which are made of cut nails. Such a machine can be built by any one who is at all skillful in mechanical work. If only a few rows of oats are to be threshed

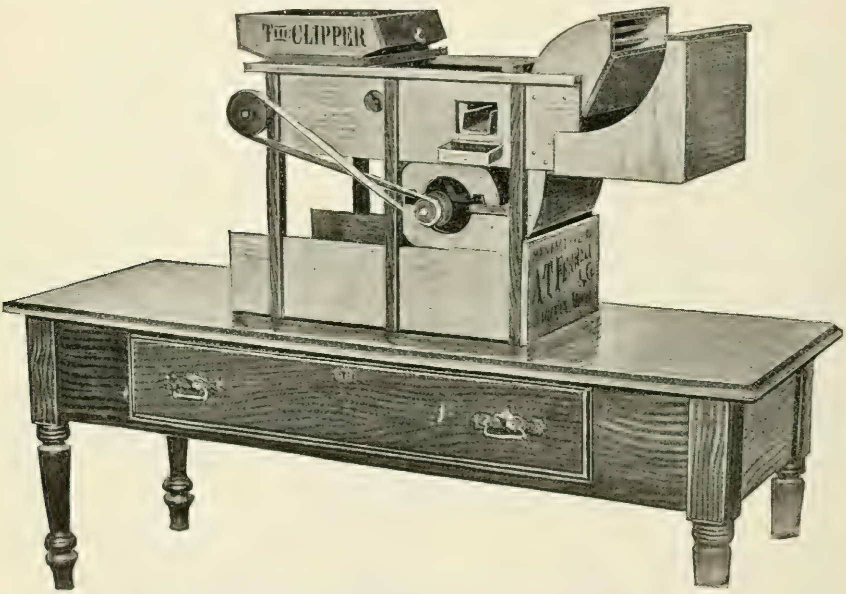

FIG. 109.— *Seed-cleaner for use with small amounts of seed*
Courtesy of A. T. Ferrel Company, Saginaw, Michigan

the machine may be turned by hand; but in work at this station, where there are many rows to be threshed, the machine is run with a motor as is shown in the illustration.

After the seed is threshed it may be freed from chaff by pouring it from one pan to another in the open air; or, if machinery for this cleaning is desired, the small counter seed-cleaner shown in Fig. 109 is recommended. This is a very handy machine, not only for oats but for all seeds from beans to the smallest grass seed.

After the seed is cleaned the product from each row should be weighed and the weights carefully recorded. The weights from the check row also should be recorded, so that the yields of the selected rows may be com-

pared with the yields of the checks, or ordinary variety. The difference between the total weight of the row and the weight of the grain gives the weight of the straw, and this difference can be used as a basis for selecting strains that produce heavy yields of both grain and straw. After this has been done the seed from the highest-yielding rows should be carefully saved and stored so that it will not be destroyed by mice or rats during winter.

It will be better to save seed from at least thirty out of the one hundred head rows. In the following season the seed from these thirty rows should

FIG. 110. — *Harvesting rod rows of oats on the plant-breeding plats of the Cornell University Agricultural Experiment Station*

be planted in longer rows, again using check rows. If there is enough seed it will be well to weigh out one half ounce from each of the thirty rows, to be sown in rows one rod long and one foot apart. When there is enough seed available it will be well to weigh out as many half-ounce lots as possible, so that two- or three-rod rows may be sown from the same head row. These rows should be sown in different parts of the field in order to overcome soil differences. The rod rows should be given the same numbers as the head rows from which the seed was selected. These numbers may be carried through to the end of the selection.

At harvest time the rod rows should be harvested separately, and care should be taken to label them so that the seed will not be mixed; the seed from these rows should be threshed and weighed separately. (Fig. 110.)

The seed from the check rows should also be threshed in the same manner, so that comparisons may again be made between the selected rows and the checks. After the seed has all been weighed and comparisons have been made, it is well to save the best fifteen selections out of the thirty and to sow several rod rows of these the following year. At the end of this time it will be possible to judge which are the better yielders, which have

FIG. 111.— *View showing plan for sowing individual seeds of small grain when it is desirable to select individual plants*

the stiffest straw, and which possess other desirable characters. The seed from the best selection can be increased very rapidly until the grower has enough of the strain to sow in a general field. If there are several selections that seem to be equally good with respect to yield and other characters, it will be safe to mix the seed of these and continue them as an improved strain. So long as the seed from these lots is carefully handled and is not allowed to become mixed in a mechanical way, as mentioned earlier in this discussion, it will remain pure and will continue to reproduce its

good qualities. The popular belief that different varieties of oats grown side by side may be mixed by the carrying of the pollen from one plant to another, is incorrect. Oats are self-fertilized and very rarely does cross-fertilization take place in an oat field. Occasionally this may occur, but it is not common enough to cause the mixing of varieties. As has been pointed out above, most of the many different types in commercial varieties of oats have arisen in other ways.

Another method of selection which is followed by the Department of Plant-breeding is illustrated in Fig. 111. By this method seeds of the variety which is to be improved are sown one at a time and one foot apart. Two or three thousand seeds should be planted in this way.

When the plants are ripe the grower should go through the plat and select the best plants. Since the plants all have the same amount of space in the field, the differences in the yields are likely to be due more to heredity than to environment. The plants selected in this way may be tested in the same manner as is outlined for the head selections.

Hybridization

Oats may be improved by hybridization, or crossing. This method has been described in detail in Lesson No. 38 of the Cornell Reading-Course for the Farm and it is not necessary to discuss the method very fully here. As stated above, oats are self-fertilized, and when crossing is to be done the oat flower must be opened before it reaches the blooming stage and the three anthers must be removed. In Fig. 112 is shown a spikelet of oats when the flower is in bloom. In Fig. 113 are shown the flower parts with the outer glumes removed. The three anthers (a) are shown, with the two-parted pistil (p) and the young embryo.

FIG. 112.—*Sketch of oats at the blooming stage, showing the anthers protruding*

Oat flowers mature very quickly after the oats have begun to head, and when crossing is to be done it is necessary to examine a number of flowers in order to determine just when the anthers may be removed, which should be before they have shed their pollen. As a rule, if one removes the anthers from the flower when they are still green, there is really no danger of shedding any pollen. After the anthers have been removed the flower should be carefully closed and the pistil allowed to develop for one or two days before the pollen from the plant of the variety that is to be used as the other parent is dusted on the pistil. As a rule the pollen will be more abundant in the afternoon, between two and three o'clock, since the oat usually blooms at about that time in this locality.

After one has had some practice it is safe to remove the anthers, or emasculate the flowers, in the morning and to apply the pollen in the afternoon. This method is not to be recommended for beginners, and should be used only when the grower is well acquainted with the nature of the anthers and knows just when they may be removed without danger of losing pollen.

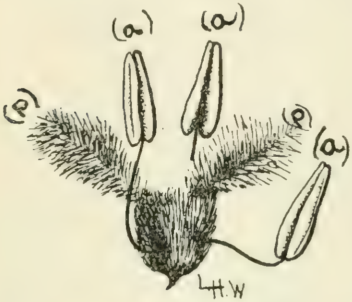

FIG. 113.—*An oat flower after the glumes have been removed, showing the anthers (a), the two-parted pistil (p), and the young embryo*

After the pollen has been applied, careful notes should be taken describing the method of making the cross. If pollen from the Silvermine variety is applied to a flower of the Sixty Day variety, the cross would usually be recorded as Sixty Day x Silvermine. In other words, in hybridization the female parent is recorded first.

In hybridizing oats it is usually better to take a single branch or spikelet of a head, so that two or three flowers may be pollinated with the same kind of pollen. The other flowers on the head may be pulled off, or they may be allowed to grow if care is taken to tag the flowers that have been crossed.

Hybridization is not recommended as a means of improving varieties unless the grower plans to become a specialist in seed production. In the first place, it is difficult to make the hybrids and there is a large amount of detail connected with the work which makes it very laborious for the grower who has many other demands on his time. In any case, hybridization should not be used as a method of improvement unless varieties are being grown which have certain characters that would tend to make a better variety if they could be combined in one strain. For example, one variety may be nearly or wholly rust-resistant, but a small yielder. Another variety may be a large yielder, but very susceptible to rust. In such a case it might be advisable to resort to hybridization in an attempt to combine these qualities in one offspring. As a rule, however, one cannot be sure that such combinations will result satisfactorily unless it is known that certain characters are transmitted and are unit characters, as described in Lesson No. 38 of the Cornell Reading-Course for the Farm. At the present time all the characters in oats have not been studied thoroughly enough so that it is known exactly which ones are transmitted through hybridization. It is known to be possible to cross one variety possessing awns, or beards, with another that is awnless, thereby obtaining an awned type. It is known also to be possible to cross a black oat

and a white oat and produce a black oat as the immediate result of the cross, which in turn breaks up according to Mendel's law, giving both black and white oats in the following year. Other characters have been studied, but these are sufficient to indicate how some characters in oats behave through hybridization.

Another objection to hybridization as a method of improvement is the fact that, since hybrids do segregate according to Mendel's law, the hybrids must be grown for two or three years before it can be known which will breed true. If the grower had practiced selection it would have been possible to grow several hundred selections, and the chances for obtaining a good-yielding type would have been much better.

Both these methods, selection and hybridization, seem to require so much detail that the question will be raised immediately as to whether this will pay. Attention is directed to some of the results that have been obtained by the Department of Plant-breeding in the improvement of oats during the last few years. New strains of oats obtained both through selection and through hybridization have been grown on the experiment station farm and have been carefully compared with many commercial varieties. The following table shows some of the results:

TABLE 3. SHOWING COMPARATIVE YIELDS OF SELECTIONS AND HYBRIDS, AND THE COMMERCIAL VARIETIES FROM WHICH THEY WERE OBTAINED

Variety or strain	Yield in bushels per acre	
	Two-years average	Gain
Welcome variety	*50.7	....
123-5. selection from Welcome variety	*65.0	14.3
Sixty Day variety	43.9	....
Selection from Sixty Day variety	55.8	11.9
Selection from Sixty Day variety	53.5	9.6
Sixty Day variety	43.9	....
Burt variety	49.3	....
Average of Sixty Day and Burt	46.6	....
Burt x Sixty Day	57.7	11.1

* Three-years average.

It will be seen that the Welcome selection shows a gain of 14.3 bushels per acre over the variety. Two selections from the Sixty Day variety made gains of 11.9 and 9.6 bushels per acre, respectively, over the yield of the variety. The average yield for the Burt and Sixty Day varieties was 46.6 bushels, while the hybrid between the two yielded 57.7 bushels giving a gain of 11.1 bushels per acre in favor of the hybrid.

These gains certainly show that selection and hybridization are effective as a means of improving the yield of oats. With these facts in mind a grower should consider very carefully whether he cannot well afford to take up some work in the improvement of seed. Improved seed will be a benefit not only to him but also to the community in which he lives.

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The Cornell Reading-Courses are two in number — the Course for the Farm and the Course for the Farm Home. The purpose of these courses is to assist persons who desire to learn but are unable to leave their work. These are not correspondence courses in the usual sense, but are a means of interesting readers in elementary agricultural subjects and important farm, household, and general rural problems. They also aim to lead the reader to express his opinion and discuss his own experience. The Reading-Courses are free to residents of New York State.

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SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

VOL. II. No. 44 | ITHACA, NEW YORK JULY 15, 1913 | PLANT-BREEDING SERIES No. 2

METHODS OF BREEDING OATS

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if information is requested.

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Published semi-monthly throughout the year by the New York State College of Agriculture at Cornell University. Entered as second-class matter October 13, 1911, at the post office at Ithaca, New York, under the Act of Congress of July 16, 1894.

1. Are many oats grown in your neighborhood? Are they grown for grain, or are they fed green?

2. Estimate the average yield obtained in your locality. Do you think this yield can be improved by better culture or better seed?

3. Give a list of varieties commonly grown in your part of the State. Which variety is the most satisfactory?

4. Is your section better adapted to early- or late-maturing oats?

5. Judged from your experience which kind of oats is better, side or panicled?

6. Should farmers in your neighborhood judge oats by the size of kernels or by ability to yield well?

7. Do you or any of your neighbors practice seed selection in oats or in any other crop? Do you think seed selection worth while for the farmer?

8. Do you plan to begin any work in the improvement of oats?

9. How would you make selections from the field?

10. Outline a method for determining the best strains of oats.

11. Which method of improvement do you think would be better to follow, hybridization or selection? Why?

Name..................................

Address................................

Date.....................

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

Entered as second-class matter at the post office at Ithaca, New York

VOL. II. No. 46 | ITHACA, NEW YORK AUGUST 15, 1913 | THE HORSE SERIES No. 2

FEEDING AND CARE OF THE HORSE

M. W. HARPER

The efficiency of the horse and the comfort with which he performs his labor will depend largely on the general care and management that

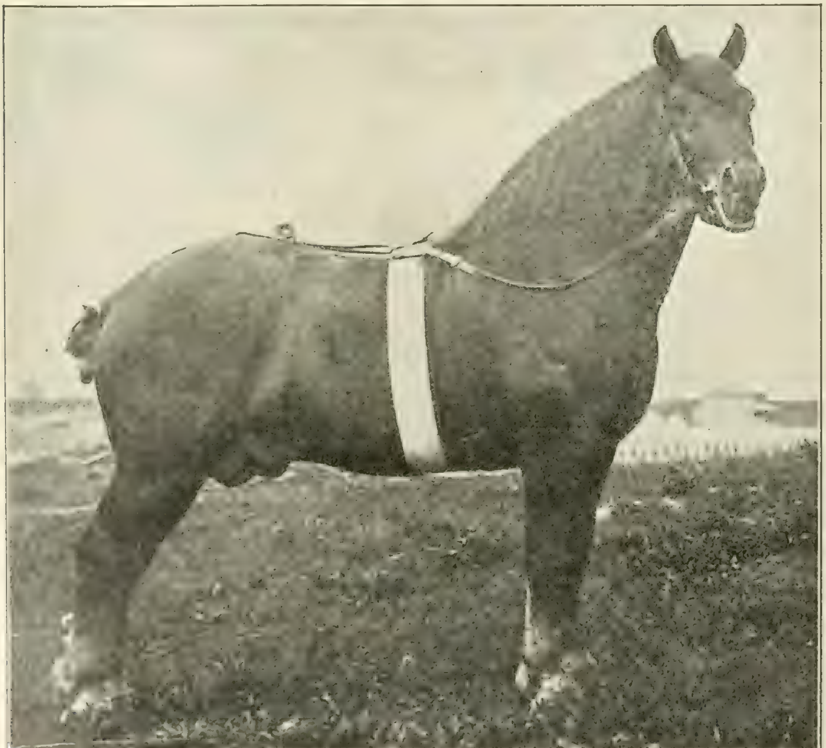

FIG. 114.— *A pure-bred Suffolk draft horse.*

he receives. In some lines of work, neglect one day may largely be made up the next, but in caring for the horse this is not possible. Injury result-

ing from neglect is always attended with loss that cannot be atoned for, even by special care given subsequently.

The successful horse-owner must be a man of industrious habits. In a sense his work is never done, owing to the constant necessity of furnishing the horse with sustenance and protection. Not only must he be devoted to his work, but also he must be gentle in his management of the horse. The horse is a very nervous animal and should be handled quietly and kindly at all times. Striking him or shouting commands at him are inconsiderate practices which not only cause the animal to lose confidence in his master and render him less teachable, but also destroy his nervous energy. He thereby becomes a less economical producer than he would be if protected at all times from such nervous shocks.

FEEDING THE WORK HORSE

The work horse should have rich food; the richer the food, the more easily it is digested and the greater is the proportion that becomes available in energy. He should be fed liberally and frequently. He has a good appetite and a vigorous digestion, and responds to intelligent care. Regularity in feeding, watering, and working brings comfort to the horse and results in long years of usefulness; while irregularity in these essentials is likely to lead to digestive disorders and other derangements.

Amount of food needed

Many experiments have been conducted in order to determine the relation between the amount of muscular work to be done and the amount of food required for its performance. As a result of such experiments, feeding standards have been established which serve to show the amount of food required each day by a working horse. The following is the Wolff-Lehmann standard. It shows the amount of dry matter and of digestible food required per 1000 pounds live weight for horses at light, medium, and heavy work:

TABLE 1.— WOLFF-LEHMANN STANDARD

Work	Dry matter (pounds)	Digestible nutrients		
		Protein (pounds)	Carbohydrates (pounds)	Fat (pounds)
Light	20	1.5	9.5	0.4
Medium	24	2.0	11.0	0.6
Heavy	26	2.5	13.3	0.8

The amount of digestible food required for light work, according to the table, would be furnished approximately by a ration consisting of 12 pounds of hay, as forage, and a mixture of 10 pounds of corn and oats taken in equal parts according to weight; for medium work, 10 pounds of hay and 15 pounds of grain mixture; for heavy work, 12 pounds of hay and 18 pounds of grain mixture.

This feeding standard should be modified according to the size of the horse as well as the amount and the kind of work that he is required to perform. In practice the work horse is supplied with approximately $2\frac{1}{2}$ pounds of provender daily for each 100 pounds weight. Of this amount, one third to two thirds — the exact amount depending on the severity of the labor — should be grain, and the remainder should be sweet, clean hay. When work is heavy the grain in the ration should be increased and the hay diminished, since grain furnishes more energy and is more easily digested. On the other hand, when work is light, the grain should be diminished and the hay increased.

Amount of food needed by individual horses

While the amount of food to be given a large number of horses can be estimated closely, yet the rations should be modified so as to meet the needs of each animal. One horse may need a little more than the regular allowance and the second horse a little less, since some horses are kept in condition less easily than others doing the same amount of work under similar circumstances.

Order of watering and feeding

Because of the small size of the horse's stomach, the order of supplying grain, hay, and water is of much importance. Investigators have shown that the stomach of the horse must be filled and emptied two or three times for each meal given. It appears that during the early stage of the meal the partially digested food is pushed into the intestines by the food that follows soon after it enters the stomach; toward the end of the meal the passage is slow and the digestion in the stomach is more nearly perfect. This being true, it would seem that the more nutritious food should be fed toward the end of the meal, especially since the important nutrients are largely digested in the stomach.

The order in which food should be given cannot be discussed intelligently without considering the time of watering the horse. Many feeders believe that the horse should be watered before feeding, while others are equally certain that feeding should precede watering. The object sought is that the horse shall be fed and watered so frequently that he will feel neither hunger nor thirst at any time. He should therefore be fed at

least three times, and watered not less than four times — if convenient, six times — each day. He should be watered in the morning before feeding, and for the morning meal should receive approximately one fourth of the daily allowance at least one hour before going to work. This food should be in a condition to be easily and rapidly consumed, so that it will be well digested when the animal goes to work. As he goes to work he should be watered, and after five hours of exhausting labor he should be given his midday meal, a second quarter of the daily allowance. Before being fed he should again have a drink of fresh, cool water, but care should be taken that he does not drink too rapidly nor gorge himself if he is very warm. If convenient the harness should be removed, so that the horse can eat in comfort and have a few minutes of much-needed rest. One hour should be allowed the horse in which to consume the midday meal. After watering and feeding he is ready for the second half of his day's work. When he has worked for five hours he should be given the evening meal. As he comes to the stable in the evening he should first of all be given a drink; care must be exercised as before to see that he does not drink too rapidly. He is now ready for the remainder of his daily allowance. Thus heavy feeding comes at night, when the horse has ample time to masticate and digest his food and is not obliged to go to work immediately.

Cost of the ration

In formulating the ration for the work horse due consideration should be given the cost, which will vary with the size of the animal and the nature of the work to be performed as well as with the cost of feed. Hays are ordinarily much cheaper than grains, especially on farms. The hard-working horse, however, is unable to dispose economically of a large proportion of bulky food, since time and energy are required for mastication and digestion of rough food.

In the choice of grains, their cost is given little or no consideration by the average person. Thus oats are fed, although they constitute the most expensive grain on the market and equally good results would be obtained by feeding some cheaper grain, in part at least.

Every feeder should make a careful study of the foods available and choose those that best meet the conditions.

Feeds for the work horse

The ration for horses usually lacks variety. If rations of horses in a given locality are studied, they are found to be composed of one kind, or at most two kinds, of grain and one forage. The owner insists that this is the most practical and economical ration that he can feed with safety

to his horses. In a second locality, at no great distance from the first, the list of food materials is found to be changing, and in some cases entirely changed, yet with the same claim of superiority or necessity as before. Such study convinces us that the range of suitable foods is very wide.

Grains.—Most of the grains fed to the horse belong to the cereal group — oats, corn, barley, rye, and wheat. These grains are similar in composition. They contain a fairly low water and protein content and a considerable amount of nitrogen-free extract, fiber, and fat. They are palatable and digestible. The choice of cereal grains for feeding the horse is largely to be determined by relative cost.

No other grain is so safe for horse-feeding as old oats, and the animal

FIG. 115.— *One method of reducing the cost of production*

is rarely harmed if by accident the feeder gives an oversupply. This safety is due to the oat hull, which causes a given weight of grain to possess considerable volume. It is said that horses fed on oats show a spirit that cannot be attained by the use of any other feeding-stuff. Many urge that this is due to a peculiar stimulating substance, called avenin, which the oat is said to possess. Oats may have a flavor that makes them a favorite food; the most careful chemical study, however, has failed to reveal any substance of the nature of avenin. Notwithstanding this, oats have many advantages as a food for horses.

Next to oats, corn is the common grain for horses in America. It is used largely in the Corn Belt and to the southward. While much has been said against the use of corn, ordinarily it is the cheapest of all the cereal grains. A given quantity furnishes more energy than does the same quantity of any other food. It furnishes the largest amount of digestible nutrients at the least cost, and is universally palatable.

Although corn is not equal to oats as a grain for horses, nevertheless, because of its low cost and its high feeding value, this grain will be used extensively where a large number of horses must be economically maintained.

Corn and oats, mixed half and half according to weight, make a very good grain ration for horses and are much cheaper than oats alone. In a three-years test with geldings and brood mares worked on farms and at heavy draft, this mixture gave equally as good results as whole oats and reduced the cost of the ration approximately ten per cent. The bulk of oats overcomes, in large measure, the objectionable features of corn; while corn, with its large amount of easily digested materials, furnishes the ration with the elements that supply energy.

Because of its physical effect, wheat bran is considered a valuable addition to the ration of horses. Bran has a loosening effect on the bowels and tends to allay feverish conditions. It is entirely too bulky to form any considerable part of the food for a hard-working animal.

Forage.— Among the many dry-forage crops fed to horses, timothy hay heads the list, although it is not particularly rich in digestible nutrients. There are many reasons for this popularity. Timothy forms the principal market hay; it is difficult to adulterate with other hays or weeds without detection; it is relished by horses; it is free from dust. All these characteristics commend timothy hay as a horse food.

In certain sections of the country clover hay and alfalfa hay are held in high esteem as a forage for horses. In other sections, however, both these hays are held in disfavor. The reasons for this are obvious. It is difficult to prevent both alfalfa and clover from becoming loaded with dust. The clover stem is not stiff enough to hold the plant upright, and when it falls to the ground more or less dirt is splashed on it by rain. Both clover and alfalfa leaves are very brittle and crumble into dust in the curing of the hay. Then, again, these hays often go into the mow so moist that fermentation takes place. During this oxidation, particles of blackened, partially carbonized leaves are produced, and this finely divided matter rises into the air in clouds of dust when the hay is moved. The dust enters the nostrils of the horse and is drawn into the lungs, where serious irritation results. This can be prevented, in large measure, by moistening the hay before feeding.

On the other hand, bright, clean clover and alfalfa are valuable foods, especially for draft horses and for growing animals, as both hays are rich in protein and in mineral matter. Both clover and alfalfa should be fed in limited quantities.

In the Corn Belt, dried cornstalks, when properly cured, are often fed as a substitute for hay. Experiment and experience have shown

that in fall, before the leaves are leached, cornstalks are as valuable as timothy, pound for pound consumed. Cornstalks cost only about one third as much as timothy and are therefore much more economical.

SALTING THE HORSE

Salt in limited quantities should be kept before the horse at all times. It is not good practice to place too much salt before him at one time, for some horses will eat to excess. Abnormal thirst is likely to follow too plentiful salting, and if sufficient water is given to relieve the thirst

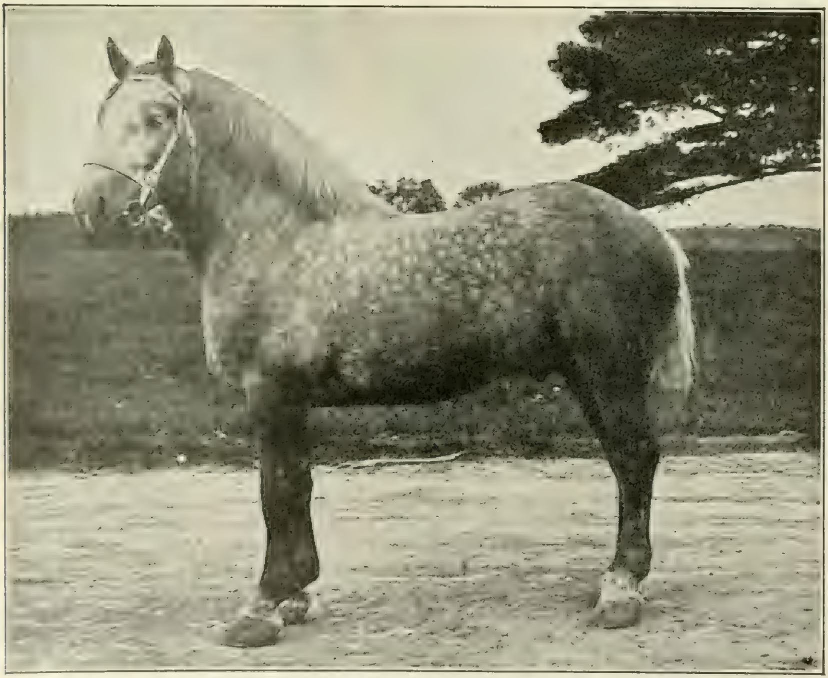

FIG. 116.— *A pure-bred Percheron draft horse*

digestive disorders may result. Salt should not be placed in the food, since this practice often causes derangement of the digestive organs.

REGULARITY IN FEEDING

The importance of regularity in everything that pertains to the horse cannot easily be overestimated. This applies particularly to feeding. Whatever feeding-stuffs are employed in the ration, the horse should be fed uniformly at all times. His digestive system and his vital activities become accustomed to a certain regularity, which must be followed if

success is to be obtained. Changing the order for even a single meal may produce more or less digestive disturbance. If, for some reason, a change must be made, it should be brought about gradually so as to give the digestive system time to adapt itself to the new ration.

PREPARATION OF FEED

The preparation of feed for the idle horse need receive little attention. Such animals have ample time to masticate their food, since their systems are not being taxed by labor. They can subsist on food containing a large amount of fibrous material, such as hay, straw, or corn fodder, fed whole, but as a rule some grain should be given in addition. When horses are taxed to the limit of their endurance, however, the preparation of their food should receive attention. In this case, possibly all grains should be fed ground and, if convenient, part of the hay should be cut or chopped. Foods thus prepared, especially small grains, are more thoroughly masticated and perhaps more thoroughly digested. Long hay, to be consumed at leisure, should of course be supplied to the animal. Since hay is always more or less dusty, it should be fed in such a manner as to cause the horse least annoyance. Moistening or sprinkling hay with water is the simplest method of reducing this trouble, although dusty hay should be avoided whenever possible. It is often asserted that soaking the feed, especially hard grain, renders it easier to masticate and improves digestibility. It is very doubtful, however, whether it is ever worth while to soak feed for the horse, provided that he is healthy and has sound teeth.

FEEDING THE DRIVING HORSE

Periods of comparative idleness followed by long drives and hours of overexertion make the feeding of the driving, or carriage, horse a difficult task. Irregular work necessitates irregular feeding, which weakens the constitution of the driving horse so that often such a horse has but a brief career. In feeding the driving horse the same general plan as that suggested for the work horse should be followed as far as possible. When the horse is not driven, the grain part of the ration should be reduced and the normal allowance should not again be given until work is resumed. Driving horses are often overfed because of a desire on the part of their owners to keep them in the pink of condition. Such overfeeding and irregular exercise are the causes of most of the ills of the driving horse.

Feeds for the driving horse

Oats and bran easily lead among the concentrates, and timothy hay among the forages. A bran mash should be given once a week if bran

is not fed more regularly. Care must be exercised in feeding laxative foods, such as green grass, clover or alfalfa hay, or too much bran, for such foods prove rather draining on the system of the horse.

FEEDING THE BROOD MARE

Many farmers are so situated that they may raise colts without seriously interfering with farm operations. This is a good practice, since there is a strong demand for horses for both city and farm use. A team of mares in foal can be worked up to the time of foaling, if the work is not too severe and if the driver is careful. In fact, moderate exercise is necessary for the well-being of both mare and foal.

Feeds for the brood mare

The brood mare should be fed such foods as have been suggested for the work horse, with perhaps the addition of more protein foods, as bran and linseed-oil meal. These foods, rich in protein and mineral matter, are valuable for mares carrying young foals. Through the use of proper foods, mares should be kept in good physical condition. The bowels should be somewhat loose at the time of parturition; if the mare is constipated, a bran mash may be given occasionally.

While the mare may be worked up to the time of foaling, she should be given a few days of rest after foaling so as to enable her to gain strength and to give the foal a good start. For the first few days of recuperation, a hot bran mash fed once a day has both a cooling and a laxative effect on the mare which is very beneficial. If all has gone well with mare and foal, the mare may be put to moderate work in two weeks from the time of foaling. Some mares, especially those with their first foals, fail to supply the proper amount of milk and the young colts do not thrive. In such a case the mare should be provided with food that will stimulate the milk flow. Good pasture grass is best when in season, but oats or wheat bran, with an occasional bran mash, serve the purpose very well. If there is an oversupply of milk, or if the milk is too rich, the food may be restricted.

FEEDING THE IDLE HORSE

On the average farm, most of the work comes during the growing season. It is more economical and is perhaps advisable that the idle horse be turned into a lot — if the lot is well protected — and roughed through the winter, rather than confined too closely in a barn. As winter comes on, the horse will grow a heavy coat of hair, which will afford excellent protection. Such horses may be maintained largely on hay, straw, or corn fodder, fed uncut, since they have time to masticate their food and

are able to subsist on food containing a large percentage of crude fiber. However, if straw or corn fodder is used, some grain should be fed in addition, say four to six pounds a day. It is considered better to have the digestive system of the idle horse moderately distended with coarse material, than to have the system contracted as would be the case if grains composed of only the requisite nutrients were supplied. If the protected area in the field is kept dry and well bedded, the horse can be

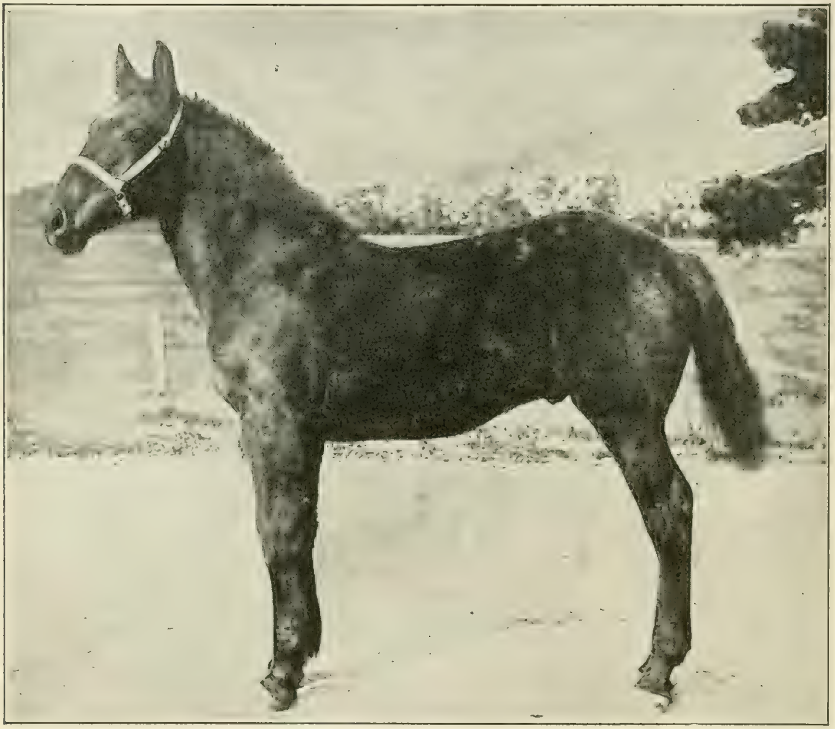

FIG. 117.—*A pure-bred Percheron weanling colt*

comfortably wintered in this way at much less expense than by stabling. In order to put the horse in condition, light work and feeding with grain should begin six weeks before the spring work starts.

FEEDING YOUNG STOCK

Since the young horse acquires practically half his weight the first year of his life, the importance of a well-balanced ration for growing stock cannot be overestimated. As soon as possible the young foal should be taught to eat grain. He will begin to munch in the dam's grain-box

at ten days to two weeks of age, and this indicates that he is acquiring an appetite for solid food. At this time it is important to encourage him to eat. Possibly he should have a separate grain-box placed where he can have easy access to it. At first he should have a grain mixture of oat meal and wheat bran, half and half by weight. The young foal will eat very little of this at the beginning, but if a fresh supply is kept constantly before him he will soon acquire the habit of eating grain. It is important that the supply be kept in fresh condition. The foal that is encouraged to eat solid food in this manner can be weaned at five to six months of age without loss of weight.

The cost of raising a colt has been much discussed and estimates vary widely. This variation is due largely to existing conditions. The cost has been estimated by computing the cost of food in some cases at market value, in other cases at the value on the farm, and in still other cases at the actual cost on the farm; thus three cost prices are quoted. The best way to estimate the cost of raising a colt is to ascertain the amount of food required; each person can then estimate the expense according to the value that he wishes to place on the food. The suckling colt fed as suggested above will consume about 180 pounds up to weaning time; as a weanling he will consume daily 5 pounds of grain and 7 pounds of hay; as a yearling, 7 pounds of grain and 18 pounds of hay; and as a two-years-old, 9 pounds of grain and 20 pounds of hay. These figures represent averages obtained from four years of work in growing colts, although draft colts consume somewhat larger quantities while lighter colts consume considerably less. The grain consists of 50 pounds corn meal, 25 pounds wheat bran, and 25 pounds ground oats, while the hay consists of sweet clover or alfalfa. The total food consumed up to three years of age is as follows:

TABLE 2. AMOUNTS OF FOOD CONSUMED BY GROWING COLTS

Age of colt	Period	Grain (pounds)	Hay (pounds)	Length of time in pasture
Suckling	June to October	180	....	5 months
Weanling	November to May.	1,050	1,470	....
Yearling	June to October	....	....	5 months
Yearling	November to May.	1,470	3,780	....
Two-years-old	June to October	....	....	5 months
Two-years-old	November to May.	1,890	4,200	....
		4,590	9,450	15 months

According to this computation, which is based on four years of experimentation, a three-years-old colt consumes on the average approximately

two and one quarter tons of grain, four and three quarters tons of hay, and pasture for fifteen months.

GROOMING

The grooming of the horse deserves careful consideration. Nothing else contributes so largely as efficient grooming to the beauty and luster of his coat. Because of this, the body usually receives sufficient attention but the legs receive entirely too little. If the animal's legs are muddy

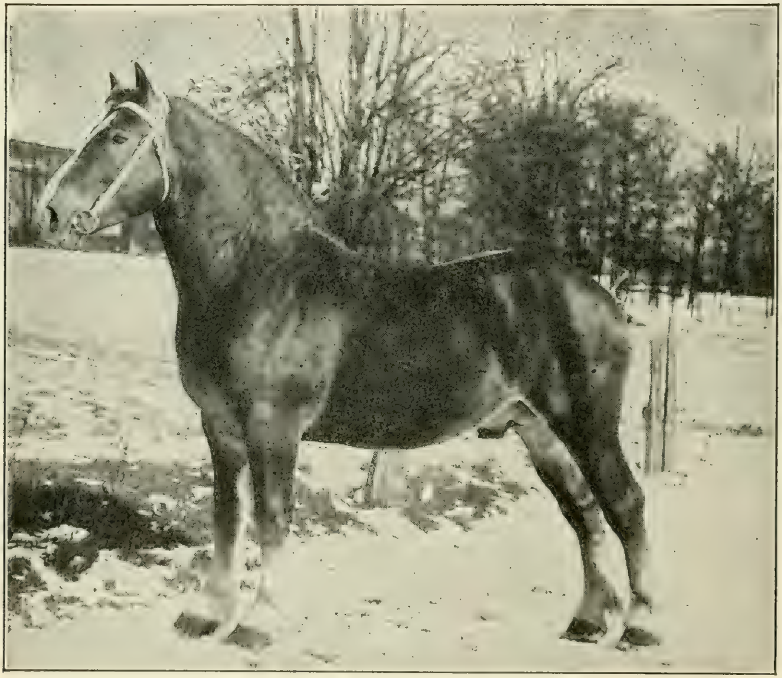

FIG. 118.— *A pure-bred Belgian draft horse*

when he arrives at the stable, they should be roughly cleaned with a half-worn, common broom; the animal should be placed in the stall, fed, unharnessed, groomed thoroughly, and blanketed. The legs should then be given a thorough, rapid brushing. Time spent in cleaning and rubbing the horse in the evening, after the day's work is done, is of much greater benefit to the animal than the same amount of time thus spent in the morning.

If the animal is working in mud it is desirable that the hair be clipped from his legs; if this is done, the legs may be kept clean with much less difficulty than if the hair is not clipped. In case the legs are clipped, it is

all the more important that they should be thoroughly cleaned and rubbed each evening after work. The hoofs should be examined and the cleft between the sole and the frog should be cleaned. Animals cared for in this manner will pay for the extra care many times over by coming from the stable in the morning in the best of spirit. This will be indicated by their pleasing appearance, the snap and vigor with which they lift their feet, and the complete absence of stiffness in their joints. Animals whose limbs are thus cared for will remain comparatively free from the many diseases to which the legs and the feet are subject. Such care will greatly increase the efficiency of the horse and will prolong his usefulness.

CARE OF THE TEETH

Occasionally a horse is found that does not feed well owing to irregular growth of his teeth. If the first, or milk, teeth are not looked after, they are likely to remain, causing the second, or permanent, teeth to grow in crooked. The mouth of a young horse should be watched closely and the persistent milk teeth should be removed with forceps. It must be remembered also that the upper jaw is somewhat wider than the lower, and, from the fact that the teeth are not exactly opposite, a sharp edge is left unworn on the inside of the lower molars and on the outside of the upper, which may cut the tongue and the cheeks. If this condition exists the edge can readily be felt by the hand, and such sharp edges, when found, should be rasped down by a guarded rasp; otherwise the tongue and the cheeks become sore, food irritates them, and the horse will not feed well.

When a horse quids his food, when he drivels, or when he evinces pain in mastication as shown by holding the head to one side while chewing, the teeth should be carefully examined. In addition to not feeding well, a horse whose teeth have unduly sharp edges is likely to drive badly, to pull to one side, not to bear on the bit or to bear on too hard, to toss the head, and to start suddenly when a tender spot is touched.

CARE OF THE FEET

Because of the great importance of the feet they should be carefully watched throughout the active career of the horse. Each evening after returning from work, as well as in the morning before being sent out, the sole of the foot should be examined and all foreign materials should be removed. For this purpose a small hay hook, with the point sharpened, is excellent. Frequently foreign bodies, such as nails or stones, either are driven into the sole of the foot or collect in the cleft along the frog, and it is very essential that these be removed if the hoof is to remain in a healthy condition. Occasionally a hoof has a tendency to dry out

and thus become hard and brittle. Such a hoof should be oiled with good oil or hoof ointment. This will soften the sole and make it less likely to crack or break. Again, it often happens that a piece is worn or broken from the side of the hoof; this throws the weight of the body in such a manner as to bring a strain on the joints, which may cause deformity. When such breaks occur the hoof should be leveled with a rasp. When horses are too closely confined in the stable the hoof grows out long and, if not trimmed, will often deform the limb and make traveling difficult. It is important, therefore, that such a foot receive proper attention.

The rate of growth of the hoof is of much importance, for it enables the owner to know how long it will take a crack — such as a quarter crack, side crack, toe crack, cleft, or calk — to disappear. When the rate of growth of the hoof is known approximately, the length of time required for such an injury to grow out is easily estimated. On the average, the hoof grows a third of an inch in a month. Hind hoofs grow faster than front hoofs, and unshod hoofs grow faster than those that are shod. While influenced to some extent by work, exercise, climate, moisture, and food, the time required for the horn to grow from the coronet to the ground varies in proportion to the distance of the coronet from the ground. The toe, therefore, grows down in ten to thirteen months (depending on its height), the side in six to eight months, and the heel in three to five months.

BEDDING

Bedding should always be used liberally. A horse at hard work needs rest at night, and much more rest is to be obtained if the horse is given a good bed. The bedding should not be permitted to become foul; foul bedding not only will lessen the comfort of the animal, but also will promote disease. Of bedding materials, straw proves the most satisfactory; when high in price it may be replaced by other materials, such as shavings from the planing mill, rejected pieces of cornstalks, tanbark, or leaves. Old straw is preferable to new, being drier and more elastic. The more broken and bruised the straw is, the less bulk and elasticity it has; hence a greater quantity is needed.

BLANKETING

In our climate the use of a blanket is indispensable. A horse will be more efficient and will endure much longer if reasonably protected against cold rains, heavy winds, and sudden changes in temperature. If the horse is warm and sweating on his arrival at the stable he should not be blanketed until he has ceased to steam, nor should he be left in a draft. If blanketed at once there is little opportunity for the horse

to dry, the blanket becomes damp, and the hair of the horse remains moist all night. In case the blanket is not used until the animal has ceased to steam and is somewhat cool — which will be in a quarter of an hour — the hair will be dry and smooth on the following morning.

Some caretakers of horses use two stable blankets. One is placed on the animal immediately after he arrives in the stable; this is removed in a quarter of an hour, being replaced by another that is to remain on the animal during the night. This is perhaps advisable in very cold

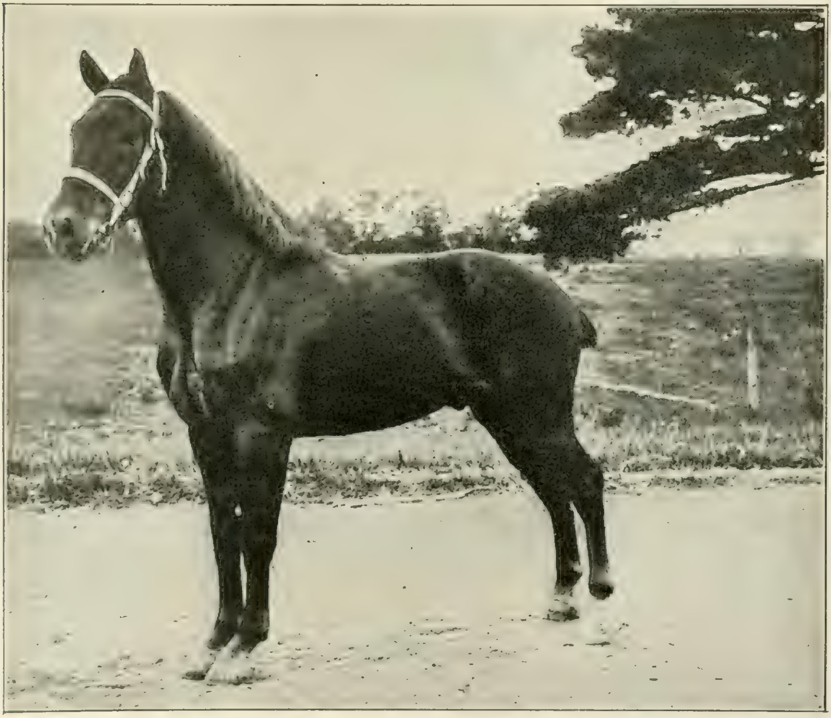

FIG. 119.— *A pure-bred Hackney coach horse*

climates, since the animal may cool off too quickly if not given some protection on arriving at the stable.

The stable blankets may be dispensed with in hot summer months if flies are excluded by screens or some other means. If blankets are used at this time they should be of light material and should be kept clean. As soon as the nights begin to be cool the use of blankets should be resumed; early use will markedly arrest the growth of hair and occasionally will obviate the necessity of clipping.

The use of the outdoor blanket is as important as that of the stable blanket. If the horse is allowed to stand outdoors for either a short or a

long time he should be well blanketed. In very cold weather the blanket should be secured about the abdomen by blanket pins.

The proper use of fly blankets or fly nets brings much comfort to the horse. Whether it is better to use nets or blankets will depend on circumstances. The blanket, being warmer and less presentable, is not advised by many persons; there are conditions, however, under which it appears very desirable, particularly on horses whose color fades on being exposed to the direct rays of the sun. Nets are more presentable and therefore are more approved by horsemen generally. Both nets and blankets are annoying to the driver, warm for the animal, and more or less expensive. For these reasons they are often discarded entirely, although their judicious use is often of advantage to horses.

CLIPPING

This consists of cutting the hair over the entire surface of the body of the horse. Several advantages are claimed for clipping: it improves the appearance of the horse and enables his coat to be more easily cleaned; a clipped horse is less likely to take cold than a long-haired horse because the evaporation of moisture is more rapid and the horse does not become so warm; the natural process of shedding hair is a draft on the vitality of the animal, leading to a diminished appetite and to loss of flesh. Clipping accomplishes in a short time what nature requires much more time to do. From this it would seem that horses having long, thick coats should be clipped.

If horses are to be clipped twice each year the first clipping should be done soon after the hair has grown out in the fall; thus the horses become used to the change before cold weather and obtain some growth of hair before winter sets in. The second clipping should be done in early spring as soon as the weather begins to grow warm and before the animals begin to shed their winter coats. Horses thus treated will be much more easily kept in presentable condition and, if protected by blankets and properly groomed, will pay many times over for such extra care. When horses cannot be protected from cold and wet, either in the stable or outside of it, they should not be clipped in the fall. Animals exposed to the weather grow a long coat for their own protection and this should not be removed; if, however, the owner means to give them extra care and attention, they may be clipped.

ADJUSTMENT OF THE HARNESS

Since the horse receives commands and accomplishes his work by means of the harness, a perfectly adjusted harness adds much to his comfort and increases his usefulness. Unequal pressure due to a poorly

fitting harness is likely to abrade the flesh and leave an impression with the horse that he is being punished, which may cause him to develop vicious habits. This is illustrated by the fact that a sore mouth produced by a poorly fitted bridle or bit may induce the horse to run away; often a sore neck or shoulder resulting from an ill-fitting collar makes a horse balk; and often a sore tail produced by an improperly adjusted crupper causes a horse to kick. Since not only the usefulness of the horse, but his safety as well, depends largely on the adjustment of the harness, much careful consideration should be given to this matter.

Sore neck and shoulders

Since the service of the horse is largely accomplished by means of the collar, it is of the utmost importance that this fit the neck and shoulder perfectly; and since the shoulders of no two horses are exactly alike,

FIG. 120.— *A well-bred, well-fed, and well-trained lot of three-years-old colts*

each should have his own collar. Unequal pressure due to a poorly fitting collar causes the horse much pain and often results in a sore neck or sore shoulders. In order to avoid such sores, the collar should be properly adjusted. Leather collars are so firm and stiff that it is often difficult to adjust them to the neck and shoulders. In order to overcome this difficulty the poorly fitting collar, whether new or old, should be wrapped round and round with thoroughly wet sacking and allowed to remain so wrapped overnight. In the morning the soaked collar should be adjusted snugly to the horse's neck with the hame straps. Then the horse should be worked moderately through the day. Soaking the collar in this way serves to soften it, after which it will adjust itself to every inequality of the shoulders and the horse will seldom be troubled with soreness.

In case such sores occur, the parts may be washed with cold salt water and, when dry, dusted with tannin or finely pulverized, air-slaked lime. Oxid-of-zinc ointment is good. This is made by mixing one ounce of oxid of zinc with four ounces of benzoated lard. If the parts become calloused a dull red-blister may be applied, which will absorb the callus. It will be necessary to rest the horse while applying the blister.

CARE OF THE HARNESS

The harness should receive good care, as this will increase the duration of its usefulness and lessen the likelihood of its injuring the horse. It is very important that the bearing parts be kept scrupulously clean at all times. This applies especially to collar, saddle, and crupper. It is not possible to prevent sores if these parts are permitted to become dirty, which they are sure to do, if not cared for, because of sweat and dandruff. Collar, saddle, and crupper should be thoroughly cleaned each morning before the horse is harnessed.

BAD HABITS AND HOW TO OVERCOME THEM

It is not uncommon for a horse to acquire whims or peculiar habits that may prove very annoying to the caretaker and dangerous to the horse as well. Some horses have the habit of rolling in the stall, making it difficult to keep them presentable; some animals tear their blankets, which are more or less expensive to replace; some horses acquire the habit of lying down cow fashion, which often results in shoe boils that are considered an unsoundness; still other horses acquire the habit of gorging grain, thus endangering their health. If the horse is to reach his maximum efficiency all such habits must be avoided or overcome.

Rolling in the stall

This habit is sometimes dangerous for the horse, as he is likely to be caught fast, particularly if his stall is narrow. The habit is perhaps due to lack of opportunity to roll. The horse should be turned into a paddock for a few minutes each evening so that he may frolic. In order to overcome the habit, a small ring should be sewed into the top of the halter, and a rope suspended from the ceiling so that it will hang directly over the horse's shoulder when he is standing at the manger. A snap should be attached to the lower end of the rope and snapped into the ring at the top of the halter. The rope should be of sufficient length to allow the horse to get his nose to the ground about where his front foot usually stands. Such an appliance will permit the horse to

lie down and get up as much as he likes, but he cannot place the top of his head on the floor and thus cannot roll.

Tearing blankets

There are at least two very common causes that induce horses to tear their blankets. First, an itching skin; since his blanket prevents the horse from biting the itching part, he bites and tears the blanket in order to get at the part. Second, the salty taste that is found in the blanket, due to sweating and other exudates from the skin, induces the horse first to lick the blanket and later to tear it.

In order to overcome this habit, a bar should be attached by one end to the halter and by the other to a surcingle. This prevents the horse from turning his head to either side and so he cannot reach the blanket with his teeth. Another, and perhaps more desirable, device is made by suspending small chains from the front, back, and sides of a nose-band in such a manner that when the horse turns his head in order to seize the blanket with his teeth, the chain appliance will prevent him from so doing. The muzzle also is often used, but the objection to its use is that it must be removed before the horse can feed.

Lying down cow fashion

This is a habit in which the horse doubles his fore legs back under his chest when lying down, in such a manner that the heels press against the elbow. The constant friction of the heels against the elbow causes boils or tumors, usually called shoe boils, to develop at the elbow joint. Such boils are very unsightly and may become painful.

There are several common methods of overcoming this habit, such as protecting the foot with a boot, shortening the inside of the heel of the shoe so as to prevent it from rubbing against the elbow, or fastening a scantling two inches square across the stall just back of where the horse usually places his front feet. The scantling hurts the cannons when the horse doubles them back under him, and in order to avoid the pain he ceases to practice the habit.

Gorging grain

Many horses have the disagreeable habit of gorging grain and swallowing it without mastication. This may result in colic. In order to overcome the habit, the horse should be watered and fed some hay before he is given grain. It is often a good plan to feed the grain in a large, flat-bottomed grain-box, as this prevents the horse from getting too much grain at one mouthful. Some horsemen recommend placing round stones in the grain-box; the confirmed grain-gorger, however, is usually an adept at throwing the stones out before eating the grain.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. BAILEY, *Director*

COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*

Entered as second-class matter at the post office at Ithaca, New York

VOL. II. No. 46 | ITHACA, NEW YORK AUGUST 15, 1913 | THE HORSE SERIES No. 2

FEEDING AND CARE OF THE HORSE

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if information is requested.

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1. What kind of grain do you feed your horses? what kind of hay?

2. How many times daily do you feed grain to your work horses? How many times do you give them hay? How many times daily do you water them?

3. About how much grain do you feed each day? how much hay?

4. At the prices that you can obtain for your grain and hay at your local market, how much does it cost to keep a work horse for one year?

5. About how many days in the year do you work your horses? How many hours do you work them on each working day?

6. Using the total annual cost as calculated above, how much does horse labor cost you by the hour?

7. Can you give any suggestions as to methods of reducing this cost, at the same time keeping the horses in good condition?

Name. . . . .

R. F. D. or street number . . . .

Post office. . . . .

Date. . . . .

The Cornell Reading-Courses
LESSON FOR THE FARM
L. H. BAILEY, *Director*
COURSE FOR THE FARM, ROYAL GILKEY, *Supervisor*
Entered as second-class matter at the post office at Ithaca, New York

VOL. II. No. 48 — ITHACA, NEW YORK, SEPTEMBER 15, 1913 — FRUIT-GROWING SERIES No. 4

CULTURE OF THE CHERRY

E. L. MARKELL

The cherry, like most of our common fruits, seems to have had its origin in western Asia. From there it was introduced into Europe nearly two thousand years ago, and its distribution has kept pace with the spread of civilization in all parts of the world. Our forefathers realized the value of this fruit, for it was one of the first fruits imported and cultivated by early settlers in America. Practically all cultivated varieties in this country have been introduced from Europe or have developed from imported varieties.

FIG. 121 — *Cherries — one of the first fruits of summer*

The cherry is grown to some extent in all parts of New York State. It is found on nearly every farm and has a prominent place in all fruit gardens. For a long time the cherry was grown only for home consumption, but in comparatively recent years orchards have been set on a large commercial scale in New York State and elsewhere. The census for 1910 shows that there are nearly 700,000

bearing cherry trees in this State, which in 1909 bore a crop worth more than a half-million dollars. This indicated a marked increase in the industry since the census of 1900.

VARIETIES

Cultivated cherries are divided into two species, of which one includes the sweet and the other the sour varieties. Sweet cherries are developed from *Prunus avium*, and sour cherries from *Prunus cerasus*.

Sweet cherries have a very characteristic growth. The trees are tall and erect, and have a glossy bark which is reddish in color and tends to peel in rings. The sweet cherry grows wild along woodlands and roadsides in many parts of this country, and is known as the Mazzard. From the species *avium* have sprung three cultivated types:

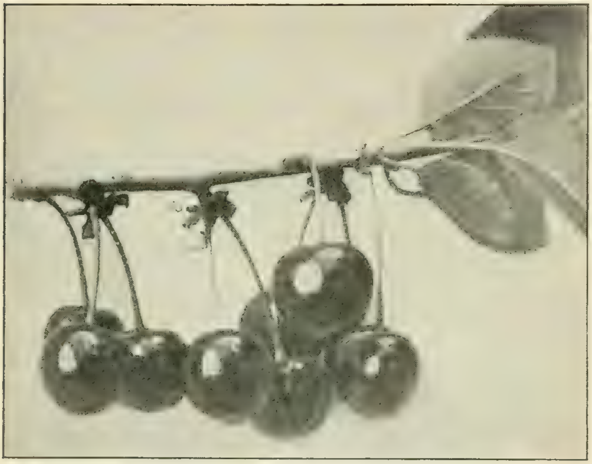

FIG. 122.— *Morello cherries*

I. **Hearts.**— Erect and vigorous growers; fruit heart-shaped, sweet, soft, light or dark color. Tartarian, Black Eagle, and Elton are examples of this type.

II. **Bigarreaus.**— Tree somewhat more spreading than the Hearts; fruit heart-shaped, but with firm, crisp flesh, sweet, light or dark. Napoleon, Windsor, and Spanish.

III. **Dukes.**— Growth smaller, with stout upright branches; fruit round, moderately tender, juicy, light-colored; flesh acid or subacid, light red to dark reddish brown. May Duke, Reine Hortense, and Late Duke. This class is probably a cross between *Prunus avium* and *Prunus cerasus*, although the characteristics of the sweet type predominate.

Sour cherries.— The trees have a low, spreading form. The bark is much darker than that of sweet cherries; it does not possess a glossy appearance nor incline to peel in large strips, as does that of sweet cherries. The fruit is generally round, red, soft, and sour. This species may be divided into two types:

I. **Amarelles.**— Trees medium size, spreading; fruit round, light red, sour; juice colorless. Richmond and Montmorency.

II. **Morellos.**— Trees small and variable in form, usually spreading; fruit spherical or heart-shaped, dark-colored; flesh dark; juice colored. Morello, Philippe, and Dyehouse.

More than ninety per cent of the cherries grown in this State are of the sour varieties. The sweet varieties have been neglected for a number of reasons: they are not so hardy nor so productive as sour cherries, and they reach perfection mainly in rolling or mountainous sections; sweet cherries are more liable to injury from sun scald, insects, and fungous diseases, and are harder to protect from the ravages of birds. Under good care and management, however, the sweet varieties may be made as profitable as the sour varieties.


FIG. 123.— *Two-years-old cherry trees in the nursery*

PROPAGATION

The cherry is propagated by budding one-year-old seedlings with the desired variety. The two stocks that are used almost exclusively for this purpose are the Mazzard and the Mahaleb, both of which are imported in large quantities from Europe.

The Mazzard is the most thrifty of all types of cherries. It is a vigorous upright grower and frequently attains a height of forty or fifty feet. Seedling trees of this type are abundant in New York and Pennsylvania, having reverted to the wild form from sweet cherries imported from Europe. This is considered the best stock on which to bud sweet cherries.

The Mahaleb is a wild cherry native to southern Europe. It is hardy and vigorous, and bears a fruit that is of small size and disagreeable flavor. This type is dwarf by nature and is a rather slow grower; for this reason sweet cherries that are vigorous and rapid growers should not be grafted on it. Sour cherries, on the other hand, are naturally somewhat dwarfed and do well on Mahaleb stock, since the growth of both top and root is well balanced.

The nurseryman prefers to use Mahaleb stock because it is cheap, because it grows vigorously when young, and because it is easily budded.

Sweet cherries will come into bearing earlier on this stock than on Mazzard because their growth is checked. The checking of growth, however, prevents the normal development of the tree and frequently causes its early death. Mahaleb stock is hardier than Mazzard, but the sweet cherry cannot be grown successfully in localities that are too severe for the latter stock.

None of our cultivated cherries succeed on the wild chokecherry (*P. virginiana*), which is common in the East. The wood does not unite well, and, although the graft may make a good beginning, the result is a gradual failure.

Grafting

The cherry may be top-worked by cleft grafting, but this operation is not so simple as in the case of the apple. The outer bark of the cherry is very tough and runs across the direction of growth instead of with it. For grafting, the stock should be at least three fourths of an inch, and preferably not more than two inches, in diameter. A smooth place should be selected on the branch that is to be grafted, and the part beyond this should be sawed off squarely. A vertical cut through the outer bark should be made on each side of this stub, and the grafting chisel should be placed so that the split will be in line with the cuts in the bark. This will prevent a ragged split, and will increase the possibility of success. Two scions should be inserted in each limb. The exposed surface should be covered with grafting wax so as to exclude air and surplus moisture. Cherries should be grafted just before growth starts in the spring.

CULTURAL PRINCIPLES

Site

The cherry is liable to injury by late frosts in spring, and for this reason it is advisable to choose a site that is elevated above the surrounding land. The crest or the side of a hill should be chosen, if possible, for such situations are less liable to frost than is a valley or a pocket. Locations near large bodies of water are especially desirable because of the moderating influence of the water on the atmosphere of the surrounding country. Sour cherries are better adapted to the lower elevations than are sweet cherries. A well-elevated location lessens the liability of sweet cherries to rot and to crack.

Soil

The best soil for the cherry is one that is rather light, such as a sandy or gravelly loam. Almost any well-drained soil will be satisfactory if it is not too heavy. Drainage is an important consideration, and its operation is especially essential to success in the growing of sweet cherries.

If land is too moist or too rich, the trees will grow rapidly and the wood will not mature. Winter injury will result, and within a few years the trunks will crack, thus admitting fungus spores so that decay and the final destruction of the tree will rapidly follow. In general, the sour cherry prefers a lighter soil than does the sweet cherry, while sour varieties require more moisture in order to develop the best fruit. The soil for both types should be retentive of moisture, and moisture is regulated to a large extent by the amount of humus in the soil. The moisture-holding capacity of the soil can be increased by the addition of vegetable matter, in the form either of cover-crops or of barnyard manure.

FIG. 124.— *Montmorency cherry trees growing by the roadside*

Planting

The cherry should seldom be planted as a filler for any other orchard tree because it requires different cultural treatment. Unlike other orchard fruits, it matures its crop early in summer and requires the remainder of the season for the proper development of fruit spurs and the maturing of wood. When the cherry is planted with such fruits as the apple or the pear, it is forced to maintain active growth for a longer period than is desirable and is frequently unable to mature its wood before winter.

The time of year for planting cherries depends on several factors. If the locality is subject to severe winter weather, it is best to delay planting until spring. If well-matured trees cannot be obtained in fall,

spring planting is preferable. One-year-old trees do not mature, as a rule, until late in autumn, and should therefore be planted in spring. Well-ripened two-years-old trees may safely be planted in fall if climatic conditions are favorable and the soil can be properly prepared.

The distance apart for planting trees depends both on the type of the cherries to be grown and on the character of the soil. If the soil is naturally rich, tree growth will be more vigorous and the trees must therefore be planted farther apart than on poorer soils. The Morello group of cherries should be planted not closer than sixteen by sixteen feet, while the Amarelles should be at least twenty feet apart in each direction. Sweet cherries develop very large trees and should seldom be planted closer than thirty by thirty feet; they generally require more space than this. It is well to plant trees at a considerably greater depth than they were planted in the nursery, since this will give them an opportunity to become established on their own roots.

FIG. 125.— *Richmond cherry tree. The head is rather high and the pruning is somewhat severe*

The age of trees for planting requires some consideration. As a rule, two-years-old trees are planted in this State. In the case of sour cherries, two-years-old trees are satisfactory provided they are not overgrown and are not headed too high. Sweet-cherry trees, on the other hand, make a much more vigorous growth than do sour-cherry trees, and for this reason are difficult to transplant. One-year-old sweet-cherry trees may therefore be transplanted much more successfully than older trees and should usually be selected for planting.

One-year-old trees should be planted in spring and headed back to about three feet; all side branches should be removed. This will cause a large number of side branches to grow along the trunk. Four to six of these branches should be selected to form the main scaffold limbs and

the remainder should be removed. The lowest branch should be about two feet from the ground, and the other branches should be arranged symmetrically around the trunk and several inches apart. This will result in a low-headed tree, which will require the least effort in spraying and picking. A low-headed tree will also shade the trunk and help to prevent sun scald, which is so troublesome, especially on sweet varieties. During the second season the main branches should be severely headed in so as to obtain a stocky growth, after which the tree will require little pruning except for the removal of dead limbs. If the branches grow long and slender they should be slightly headed in for the first few years. The cherry has a tendency to grow too many intermediate branches. If these branches become too thick, the cross limbs should be thinned so as to insure good circulation of air and plenty of sunshine. The fruit will then mature as well on the inner branches of the tree as on the more favored outer branches.

Tillage and cover-crops

Tillage of the soil is of as much importance for the cherry as for other fruits. The ground should be plowed very early in spring in order to conserve as much moisture as possible. Spring plowing is especially important if a cover-crop is grown, since a cover-crop that survives the winter will rapidly dry out the soil in the spring. Such soil should be thoroughly worked at regular intervals, or at least whenever the land becomes baked and after heavy rains, until the crop is harvested. The maturing fruit requires an abundance of water; if this is present in sufficient quantities it will greatly increase the size of the crop. Tillage is especially necessary during the early life of the cherry orchard, because it insures rapid growth and development. For the first five years the orchard may be intercropped, and for this purpose some low-growing, tilled crop, such as beans, potatoes, tomatoes, or cabbage, should be chosen. If intercrops are grown, sufficient fertilizer should be applied to meet their requirements and also to supply the needs of the young trees. When the soil is too rich, and the trees are making too vigorous growth, they may be checked by seeding down the orchard for one year.

It is best not to till the cherry orchard after the early part or the middle of July, since tillage may stimulate the growth of the trees for a longer period than is desirable. As a result they may not mature properly, thus becoming liable to winter injury. At the time of the last harrowing a cover-crop should be sown. The kind of cover-crop depends on the character of the land to be seeded. If it is low in fertility, one of the legumes, such as clover or vetch, should be sown, while on soil that contains sufficient nitrogen a non-leguminous plant, such as oats, rye, or buckwheat, should be sown. A combination of the two crops is generally most desirable.

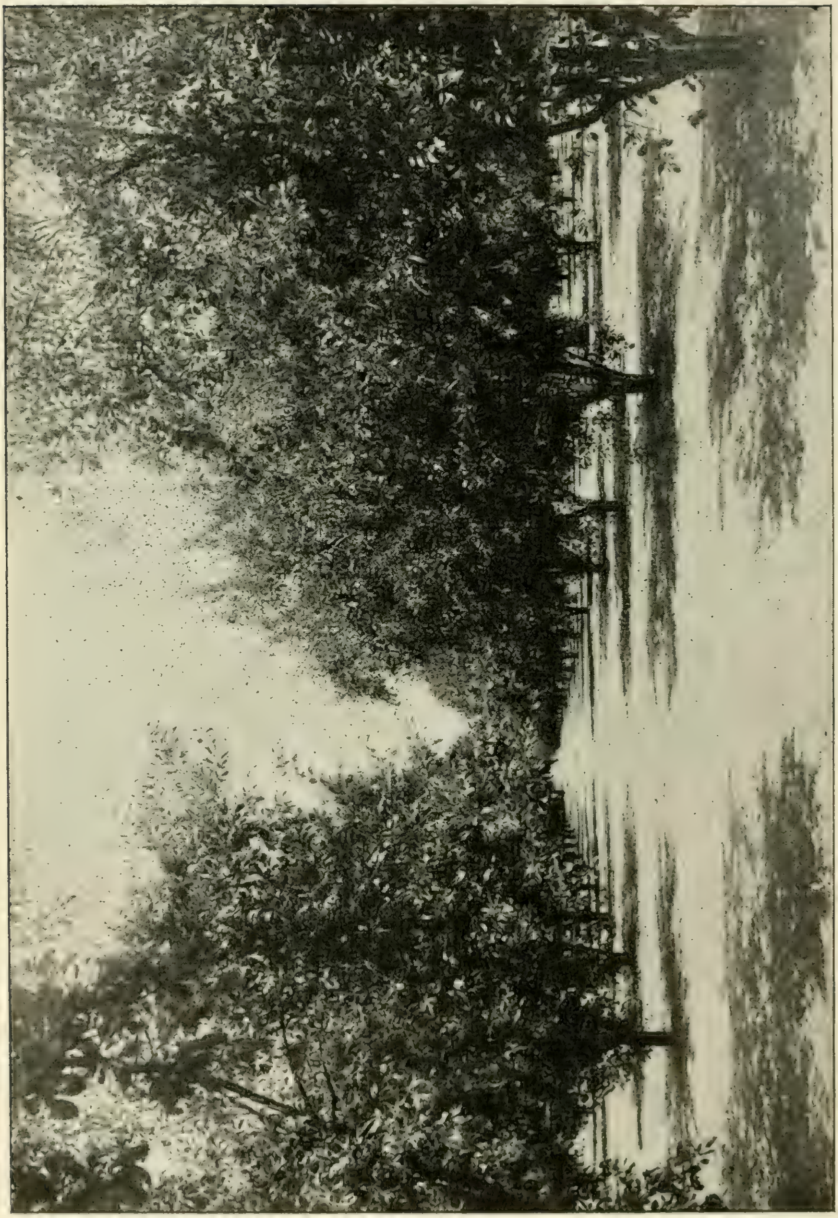

FIG. 126.— *An orchard that shows careful management*

Fertilization

The cherry needs an abundance of plant food and frequently requires fertilization. Many growers apply a light covering of manure to cherry orchards every year, or make a moderately heavy application about once in two years. Commercial fertilizers are used either alone or in combination with manure. Three or four hundred pounds of acid phosphate or bone meal and two hundred pounds of sulfate or muriate of potash applied annually should give good returns in a cherry orchard. Under most conditions all the nitrogen required should be readily obtained from cover-crops. In the case of sickly trees — a condition which may be indicated by the pale color of the foliage — an application of one to three pounds of nitrate of soda per tree, depending on the size, may be beneficial. Sweet cherries require less additional plant food than do sour cherries.

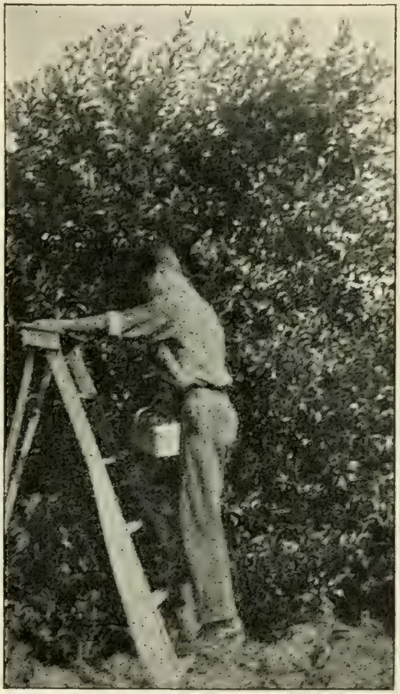

FIG. 127.— *Picking Montmorency cherries. Tree six years old*

PICKING

Most of the picking should be done from stepladders. The three-legged type of stepladder is most desirable, and several sizes should be kept if there are many trees. If the trees are very tall a few two-rail ladders will also be needed. A very satisfactory receptacle for picking is the common eight-pound grape basket, which is of convenient size and may be readily fastened to the belt of the picker. A larger basket than this is undesirable because the bottom fruits are pressed too heavily. Cherries are often shipped in the eight-pound baskets, and in this case less handling is necessary if they are picked directly into this package. In picking cherries, much care should be exercised to prevent the removal of fruit spurs, for these are to bear the crops of future years; the pickers will need careful supervision. The cherry should be removed by grasping the stem, not the fruit, and by giving it an upward pull. Fruit should not be pulled off the stem; the juice of one stemless cherry placed in a basket of fruit will catch dust and dirt and stimulate rotting, which may destroy the market value of the entire basket. Cherry-picking

is an art that requires practice. Women and children do most of this work, and in cherry sections they look forward to the picking season with a great deal of pleasure. The novice can seldom pick more than one hundred pounds a day, but he will gain speed rapidly and should be able to pick two hundred pounds a day by the end of a month if the trees carry a heavy crop. An expert can often average three hundred pounds a day without much difficulty. Pickers are hired either by the day or by piece work, and in the latter case they usually receive a cent a pound, but the price will vary with the size of the crop. If the fruit is to be shipped to the general market the trees should be gone over two or three times, since the fruit should be well ripened before it is picked. Cherries for canning may be allowed to become much more mature, and thus practically all of them can be harvested at once. A pound of fruit with stems will measure about one and one fourth quart.

YIELDS

The yields of a cherry orchard will vary from year to year and under different soil and climatic conditions. Sour cherries are usually more productive than sweet, and they come into bearing earlier. The Morello will bear a fair crop about three years after it is planted, if two-years-old trees are set, whereas a Montmorency tree will usually come into profitable bearing in five years. At this age five hundred to one thousand pounds per acre may be expected if trees are planted twenty by twenty feet apart. A two-acre Montmorency orchard at Westfield, New York, yielded six tons in 1911. This yield gave a gross return of $300 per acre after the orchard had been planted six years. In 1910 it had yielded one ton, and in 1909 one half ton. After ten years a sour-cherry orchard will frequently average five tons per acre. A thirteen-years-old Montmorency orchard at Hilton, New York, is said to have produced over twelve tons per acre for three years in succession. Sweet cherries frequently give high yields, but the trees are uncertain in bearing. An average of four to five tons per acre for a mature sweet-cherry orchard is a fair estimate.

As a rule, the profitable life of a cherry orchard may be estimated at twenty-five years, but under good care and management this may be increased. Most of the cherry crop of this State goes to canning factories. Many growers contract their fruit for years in advance at a fixed price of five cents a pound. At this figure cherry-raising is a profitable industry.

For fruit that is shipped to the canning factory, the package is of no great importance as long as the fruit is delivered in good condition and will keep until it is canned. For this purpose the eight-pound grape

basket is largely used, although the twenty-pound basket is used to some extent. For the general market, also, the eight-pound basket provides a satisfactory package. The finer varieties of cherries, however, should be placed in smaller packages. Many cherries are shipped in quart boxes in twenty-four- or thirty-two-quart carriers, although very fancy varieties may often be packed to good advantage in the ten-pound box used in the West. The latter makes an attractive package if the work is carefully done. In packing, the bottom layer is faced by placing the fruit in straight rows across the box, the cherries being placed on their sides and the stems drawn up. The box is then filled compactly, nailed, turned over, and the faced side is marked. The extra cost of packing is more than repaid by the increased value of the fruit. The package used is of such importance that it will be worth while for the grower to learn beforehand from the commission men the demands of the market that he desires to supply.

FIG. 128.— *Windsor cherries*

SELECTION OF VARIETIES

The selection of varieties for planting should receive careful consideration. In the first place, it should be determined whether the fruit is to be grown for home consumption or for commercial purposes. Varieties for the home garden should be confined to those that are high in quality and that have a good succession. By careful selection of varieties it is possible to extend the cherry season through most of the summer. There are many varieties of cherries, but only a few are of known commercial value in New York State. The commercial grower should confine his attention to these, and should select only those especially adapted to his locality. He should not attempt to grow too many varieties, but should arrange a succession of three to five that may be harvested one after another. A large number of varieties would add to the difficulties of picking and handling and would be harder to dispose of. The following varieties of cherries, arranged approximately in their order of importance, are reported as highly successful in New York State: Montmorency, Richmond, Morello, Tartarian, Napoleon, Spanish, Wood, Windsor, May Duke, Dyehouse, and Large Montmorency.

The chief varieties grown and those in greatest demand do not coincide very closely. This fact is indicated by the following list, which was compiled in 1909 from reports obtained from thirty-four commission men in the principal cities in the northeastern part of the United States:

Variety	Number of markets calling for same variety
Tartarian	25
Richmond	21
Morello	18
Montmorency	15
Napoleon	15
Oxheart	12
Bing	5
May Duke	5
Windsor	2
Wood	2
Centennial	1
Baldwin	1

A few of the most valuable varieties of cherries are described on the following pages. It is hoped that these brief descriptions will be of some value in assisting the prospective cherry-grower to select varieties for planting.

SWEET CHERRIES

Bing.— Originated in Oregon. A seedling of Black Republican. Fruit very large, heart-shaped to roundish, almost black; stem short, thick; skin tough; flesh dark purple-red, firm, meaty, juicy; flavor rich, sweet; quality excellent. Mid-season to late.

Tartarian (*Black Tartarian*).— Originated in Russia. Fruit large, heart-shaped, purplish black; stem long, slender; skin thick, tender; flesh deeply colored, half tender; flavor very mild, sweet, pleasant; quality very good. Mid-season. This is the most popular market variety of sweet cherry. It is very productive and ships well.

Wood (*Governor Wood*).— Originated in Ohio. Fruit medium to large-sized, round, heart-shaped, light yellow shaded with red; stem long; skin thin, tender; flesh tender, juicy, sweet, flavor delicious; quality good. Season early. A very popular early cherry that is good for early market and home use. It is likely to crack badly.

Lambert.— Originated in Oregon. Fruit large to very large, heart-shaped, deep yellow, covered with red at maturity; stem heavy, short;

skin thick, tough; flesh dark-colored, firm, rich, juicy; flavor mildly subacid; quality excellent. Mid-season to late. One of the best commercial varieties in the West. Very satisfactory bearer. Has not been tested very widely in this State.

Napoleon (*Royal Ann*).— Originated in Europe. Fruit large, heart-shaped, light lemon-yellow with red blush; stem long; skin thin, tough; flesh light yellow, firm, brittle, juicy; flavor sweet, rich; quality good. Mid-season. Probably the best light-colored sweet cherry. Tree vigorous and very productive. Fruit cracks and rots badly in wet weather when nearly ripe.

Oxheart (*Major Francis*).— Originated in Europe. Fruit medium-sized, heart-shaped, light yellow with red surface color; stem long, slender; skin thin, tender; flesh soft and melting; flavor sweet, pleasant; quality very good. Mid-season. This variety is excellent for the home garden or for the local market, but it is too tender for the general market.

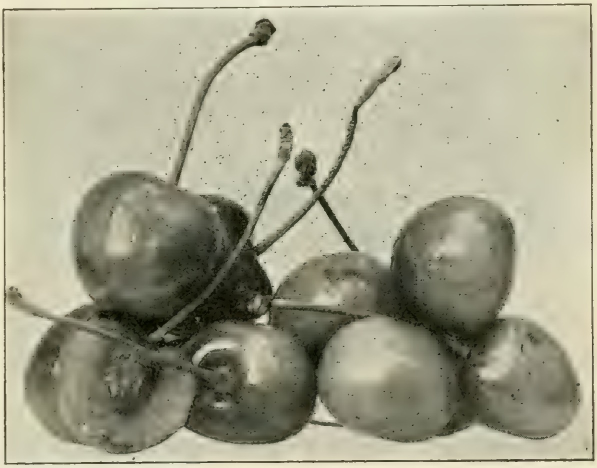

FIG. 129.— *Napoleon cherries*

Windsor.— Originated in Ontario, Canada. Fruit large, roundish, heart-shaped, dark purplish red; stem fairly long; flesh dark red, very firm, juicy; flavor sweet, pleasant; quality very good. Mid-season to late. This is one of the newer varieties of prominence that are rapidly growing in commercial importance. It is valuable because of its late season and good shipping qualities. It often cracks badly when nearly ripe.

Spanish (*Yellow Spanish*).— Originated in Europe. Fruit large to very large, heart-shaped, light waxen yellow with a light red cheek on the sunny side; stem long; flesh firm; flavor rich, pleasant; quality good. Mid-season. Larger and of better quality than Napoleon, but not so productive. Inclined to crack when ripening. Good for home use and local market.

May Duke (*Early Duke*).— Introduced from Europe. Fruit large, round to heart-shaped, dark, rich red; stem long and slender; skin thin

and tender; flesh reddish, tender, juicy; flavor rich, subacid; quality very good. Season early. This is a very old variety. It is thrifty and comparatively hardy, although its blossoms are sometimes caught by late frosts. It is rather uneven in ripening and is somewhat tender for shipping. It is recommended for home use.

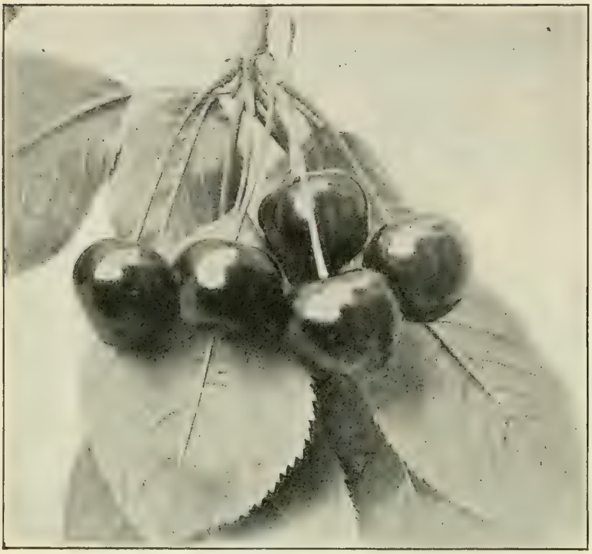

FIG. 130.— *May Duke cherries*

SOUR CHERRIES

Baldwin.— Originated in Kansas as a sprout of Richmond. Fruit medium in size, roundish, bright red; flesh soft, juicy, tender; flavor subacid, rich; quality good. Season early. This is a very promising variety.

Dyehouse.— Originated in Kentucky. Fruit medium to small, roundish oblate, bright red; stem short, stout; skin thin and tender; flesh soft and juicy; juice colorless; flavor slightly acid; quality very good. Mid-season. The tree is not quite so large as Richmond, but it is more productive and the fruit is a little better in quality. A good early market variety.

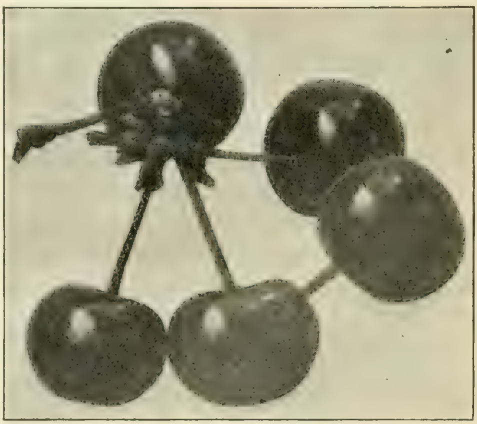

FIG. 131.— *Richmond cherries*

Richmond (*Early Richmond*).— Introduced from Europe. Fruit medium size, roundish oblate, bright red; stem short, thick; skin thin and tender; flesh soft, watery; juice colorless; flavor acid, mild and pleasant when ripe; quality good. Early to mid-season. This is one of the best of the old varieties. It is

a very regular bearer, but not so productive as some of the other varieties. The fruit is too tender to ship long distances, since it holds up well for only a day or two after picking.

Morello (*English Morello*).— Introduced from Europe. Fruit medium to large, roundish to heart-shaped, dark red; stem short and thick; skin thin and tender; flesh very dark, meaty, juicy; flavor very acid; quality fair. Season late. This is one of the best varieties of the Morello type. It is hardy, productive, and an excellent shipper. It is popular with the extract manufacturers because of its dark color and rich, acid flavor.

Philippe (*Louis Philippe*).— Introduced from France. Fruit medium to large, round, dark red; flesh red, tender, juicy; flavor acid, rich; quality very good. Mid-season. A very good variety but not a heavy producer.

Montmorency (*Montmorency Ordinaire*).— Of European origin. Fruit large, roundish to obscurely heart-shaped, light red color; stem medium to long; skin thin and tender; flesh meaty, tender, juicy; flavor subacid, rich, pleasant; quality very good. Mid-season. This variety ranks first among the commercial sour cherries. It is very productive and is doubtless one of the most profitable to grow. It is popular for canning purposes.

Ostheim (*Russian Cherry*).— Introduced from Russia. Fruit medium, dark red, slightly heart-shaped; flesh dark red and firm, juicy; flavor very acid and slightly astringent; quality fair. Mid-season. This variety is generally too small to be valuable for general cultivation. It is very hardy and productive, however, and is recommended for localities exposed to severe winter conditions.

Wragg.— Originated in Iowa as a sprout of Morello, which it closely resembles. Fruit medium to large, roundish, heart-shaped, dark red; stem rather short; skin thin and tender; flesh firm, tender, and slightly stained; flavor acid; quality medium. Season late. One of the promising newer varieties now considered distinct from Morello, and differing from it in being larger and later.

PROTECTION AGAINST BIRDS

Birds are among the most troublesome enemies of the cherry-grower, and it is often a serious problem to protect the crop from their ravages. This problem is especially serious in sweet-cherry orchards, and wherever the number of trees planted is small. In larger orchards the loss due to birds is not so noticeable. The only satisfactory means of protection against such ravages is obtained by planting decoy trees of other fruits in order to keep the birds away from the cherries. Either native or cultivated varieties of the mulberry afford one of the best fruits for this purpose, since mulberries ripen with the earliest cherries and are a favorite fruit of birds. The best cultivated variety of mulberries for

New York State is New American. A few mulberry trees scattered about the outskirts of the cherry orchard will do much toward reducing the damage caused by birds.

INSECT ENEMIES

The more important insect pests that attack the cherry are the black cherry aphis, the plum curculio, the cherry fruit-flies, and the pear slug. A number of scale insects are of minor importance.

Black cherry aphis (*Myzus cerasi*).— This insect is a serious pest only on sweet varieties. It is a small, dark brown or nearly black, sucking insect that is first found on the young succulent shoots early in spring. This insect often occurs in great numbers and attacks the underside of the leaves, causing them to curl and also stunting the shoots. It excretes a sweet substance known as honeydew, which covers the foliage and fruit and renders the latter unfit for market.

Control.— " Black Leaf 40 " tobacco extract, one pint to one hundred gallons of water, should be used as a spray. Four or five pounds of soap should be added so as to make the solution spread and stick better. This is a most satisfactory spray to use against the pest. In case the extract cannot be obtained, kerosene emulsion diluted with six parts of water may be used.

Plum curculio (*Conotrachelus nenuphar*).— In certain seasons and localities this insect destroys fifty per cent or more of the crop. It attacks the sweet cherry mainly, but is sometimes troublesome on sour varieties. The adult is a small snout beetle about one quarter inch in length, which hibernates in stone piles or fences, hedges, or adjoining woodlands. It emerges in spring just as the trees are blossoming, or a little earlier. As soon as the fruit is formed, the female inserts its eggs under the skin of the cherry and makes a characteristic crescent-shaped cut beneath them. The eggs hatch in about five days, and the larvæ are the common white " worms " so often found in all stone fruits.

Control.— Just after the blossoms fall the trees should be sprayed with arsenate of lead, six to eight pounds to one hundred gallons of water. The process should be repeated about ten days later. The cherry orchard should not be located in the neighborhood of stone piles, rubbish heaps, or woodlands. Avoiding such a location will be a better means of obtaining freedom from the ravages of the plum curculio than will spraying.

Cherry fruit-flies (*Rhagoletis cingulata and Rhagoletis fausta*).— These insects are especially troublesome on sour cherries, although they are rather common on all varieties. The adult emerges about the middle of June, feeds on the surface of the foliage and fruit, and about two weeks

later begins to lay its eggs. The insect inserts its egg just beneath the skin of the cherry and the egg hatches in two to four days. Infested fruit generally decays on the tree.

Control.— There is some evidence to show that arsenate of lead, four pounds to one hundred gallons of water, applied to the foliage as soon as the insects appear, is an effective means of control. Sweetened poison has been found to attract these insects and has been used with considerable success. The following formula is suggested:

Arsenate of lead..................................	5 pounds
Cheap molasses..................................	3 gallons
Water..................................	100 gallons

This spray should be applied as soon as the insects appear. A second application should be made two weeks later if necessary.

Pear slug (*Eriocampoides limacina*).— This slimy, olive-green insect attacks the leaves of the cherry and of other fruits and feeds on the upper surface, skeletonizing the leaves and frequently causing them to turn brown and fall away. The insect first appears on young foliage in June, and often a brood appears about August.

Control.— A spray of arsenate of lead, four pounds to one hundred gallons of water, should be applied as soon as the insects are found on the leaves.

DISEASES OF THE CHERRY

Black knot (*Plowrightia morbosa*).— This is one of the most serious diseases of the cherry, and is almost if not entirely confined to sour varieties. It is caused by a parasitic fungus that produces black knotty growths on the branches. The fungus is transmitted by spores, which winter over in the black knots.

Control.— The only means of controlling this disease is to remove and destroy all the knots before growth starts in the spring.

Brown rot (*Sclerotinia fructigena*).— This disease, which is troublesome mainly on sweet cherries, is serious and is difficult to control. The rotting of the cherries often results in a loss of one half or more of the crop. The fungus frequently attacks the blossoms as well as the fruit. The fruit is susceptible to this disease principally during the ripening period. When hot, moist conditions at picking time have caused the fruit to crack, the spores can enter, and thus during wet weather an entire crop may be destroyed in twenty-four hours. The spores of the fungus causing this disease pass the winter largely in mummified fruit on the trees or on the ground.

Control.— Bordeaux mixture 4–4–50 or self-boiled lime-sulfur 8–8–50 should be used as a spray. Two pounds of arsenate of lead should be

added to either of these in order to control the curculio. The first application should be made one day before the blossoms open, and a second application should be made when the young fruit is set. If the disease has not been controlled by previous applications a later spraying may occasionally be necessary; this should be applied at least ten days before the time for picking. The arsenate of lead should be omitted if this spray is applied.

Leaf spot (*Cylindrosporium padi*).— This is a fungous disease which causes the leaves to become thickly covered with reddish or brown spots and to fall prematurely. This greatly impairs the vitality of the trees and winterkilling sometimes results.

Control.— The spraying recommended for brown rot will usually control this disease. If very serious, however, two more applications of bordeaux mixture may be necessary. The solution should be applied at intervals of two weeks.

THE CORNELL READING-COURSES

The Cornell Reading-Courses are two in number — the Course for the Farm and the Course for the Farm Home. The purpose of these courses is to assist persons who desire to learn but are unable to leave their work. They are not correspondence courses in the usual sense, but are a means of interesting readers in elementary agricultural subjects and important farm, household, and general rural problems. They also aim to lead the reader to express his opinion and discuss his own experience. The Reading-Courses are free to residents of New York State.

Course for the Farm.— The Reading-Course for the Farm is planned to assist persons who desire to read reliable agricultural literature. Enrollment in this course is by the following subjects: the soil, poultry, rural engineering, farm forestry, the horse, dairying, fruit-growing, farm crops, stock-feeding, vegetable gardening, plant-breeding. A series of lessons on each of these subjects is in progress. Twenty-five lessons are at present available and the number is increased by the publication of a lesson each month. Each lesson is accompanied by a discussion paper containing questions on the important points in the lesson. If the discussion paper is returned by the reader it is read carefully, a personal reply is made when information is requested, and another Reading-Course lesson in the same series is sent if available or references for advanced reading are given if desired. In this way individual attention is given to every reader, to the end that consecutive instruction may be received by him. New lessons on the subjects selected are sent as they are issued. It is hoped that the discussion paper may be a means of personal contact between

the College and the individual farmer in the State. By means of the discussion paper members of the Reading-Course may obtain suggestions on the agricultural problems that they are facing. The College in turn will appreciate any expression of opinion by the readers, since the experience of those in touch with local conditions presents to the College a point of view which is highly valued.

Course for the Farm Home.— This course was instituted in order that the problems of the farm home could be studied in the same scientific way as are those of the farm. The lessons are on such household subjects as relate to food, shelter, and clothing, and are accompanied by discussion papers. Further information may be obtained by addressing the Department of Home Economics, College of Agriculture, Ithaca, New York.

CORNELL STUDY CLUBS

Often the greatest benefit from the Reading-Courses has been derived by the organization of study clubs. When persons discuss Reading-Course lessons together, there is an added interest and an opportunity for an exchange of ideas, which often results in mutual helpfulness among members of the group. These clubs may include men, women, and young persons, and may have social features as part of the programs for the meetings. The two Cornell Reading-Courses — the Course for the Farm and the Course for the Farm Home — provide lessons of particular interest to both men and women. Study clubs may confine themselves to lessons in either course; or, if one club is composed of both men and women, the lessons in the two courses may be alternated, or two separate groups may be formed holding part of the program in common.

The organization of a club for the purpose of studying lessons for the farm can easily be effected even if at first only a few persons desire to form such a club. A meeting of those interested in Reading-Course lessons should be called at some convenient time and place, when a president and secretary may be chosen and the dates for meetings decided on. The president should be responsible for the success of the meetings and should act as presiding officer. The duties of the secretary will be to correspond regularly with the Supervisor of the Reading-Course and to obtain lessons for distribution at meetings of the club. The lessons should be distributed one week in advance and the members should be urged to come to the meetings prepared to discuss the lessons. Speakers should be chosen who will present the subjects taken up in the lessons. Arrangements should be made far enough in advance of meetings to enable the speakers to obtain information on their subjects from as many sources as possible. On request special references for reading will be given by the Supervisor of the Reading-Course. The meetings of a

club should be held frequently enough to maintain an active interest in them; regularly every two weeks during the fall and winter is usually considered sufficiently often. If it is not advisable to meet every fortnight in spring and summer, monthly meetings are suggested. The meetings should proceed under a definite order of business.

The interest shown in a study of Reading-Course lessons for the farm will depend largely on whether the lessons are related to local agricultural conditions and whether they deal with operations in progress at the time of year in which they are being discussed. It would be well for each club to choose its own lessons for study. Before the first meeting a list of available lessons should be obtained. If appropriate lessons are not available, the Supervisor of the Reading-Course for the Farm will help the secretary of the study club to obtain suitable bulletins as far as possible.

Whenever desired, study clubs may be conducted in connection with the educational work of granges, churches, schools, and local agricultural societies. The following three ways are suggested in which Reading-Course lessons may prove valuable to a study club or to any other organization:

1. For study by the entire membership previous to a general discussion at a regular meeting.

2. To aid speakers in preparing for a program at a regular meeting.

3. For reference. A set of available lessons may be obtained for use by a study club or for the library of any church, school, grange, or recognized agricultural organization.

SUPPLEMENT TO

The Cornell Reading-Courses

LESSON FOR THE FARM

L. H. Bailey, *Director*

Course for the Farm, Royal Gilkey, *Supervisor*

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CULTURE OF THE CHERRY

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, with a view of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if information is requested.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, VEGETABLE GARDENING, PLANT-BREEDING. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to receive the other lessons in this series should therefore sign and return this discussion paper whether the questions are answered or not.* The Reading-Course will endeavor to aid in the solution of farm problems and in the organization of study clubs, and to give references for advanced study. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.*

1. Why has the sweet-cherry industry of the State been neglected?

2. Name the different groups, or classes, of sweet and sour cherries, and mention the points of distinction between them.

3. Regarding only the characteristics of the tree, how can you distinguish between sweet and sour cherries?

4. What stock is best for sweet cherries? Why?

5. Describe a good method of top-working the cherry.

6. What factors influence the distance apart for planting cherry trees? Give the proper distance apart for planting cherries belonging to each of the different groups.

7. Describe the pruning of a cherry tree from the time of setting until it comes into bearing.

8. Why is tillage necessary in the cherry orchard? Outline a plan of tillage for the cherry orchard.

9. What fertilizers should be used in a sour-cherry orchard? Give amounts to be used and methods of application.

10. Give directions for harvesting cherries.

11. Mention five varieties of sweet and five varieties of sour cherries suitable for planting in your locality.

12. How does the cherry aphis, or cherry louse, affect the trees? How can it be controlled?

Name.......................................

R. F. D. or street number..........................

Post office.................................

Date........................

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